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Are the Math Scores of Students Who are Taught Mathematics Utilizing the Methods Endorsed by the Alabama Math, Science, and Technology Initiative Affected?

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Abstract of a Dissertation
Submitted to the Graduate Studies Office
of The University of Southern Mississippi
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ABSTRACT

ARE THE MATH SCORES OF STUDENTS WHO ARE TAUGHT MATHEMATICS UTILIZING THE METHODS ENDORSED BY THE ALABAMA, MATH, SCIENCE, AND TECHNOLOGY INITIATIVE AFFECTED?

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Eighth grade mathematics scores from 21 schools were compared pre-inception and post-inception of the Alabama Mathematics, Science, and Technology Initiative (AMSTI).Only the scores from schools which had 80% of their mathematics and science teachers trained at one Summer Institute were used, as these were considered to be true AMSTI schools. Results found the effects of AMSTI to be not statistically significant.

The second part of this research was conducted based upon 256 surveys from teachers attending their second Summer Institute of ASMTI training. Results found many school systems may hamper teachers' ability to plan and execute AMSTI lessons due to non-instructional demands and local pacing guides.

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CHAPTER I

INTRODUCTION

Descartes, one of the most notable mathematicians of all time, said, "Cogito, ergo sum," or, "I think, therefore I am." Descartes was so sure of his mathematical abilities and his ability to think through problems that he believed he could use mathematics to do more than just computation. He felt one could apply math to study all areas of human interest (Aczel, 2005). Since the death of Descartes in 1650, the subjects of human interest have evolved and studies have certainly become more in-depth. The advancements in science, technology, and global awareness are astounding. However, Descartes was correct; with a good foundation in mathematics, many things are possible.

Yet, something is amiss. Students in the United States are not doing as well in math as their peers in other nations; once United States students pass beyond the fourth grade, their test scores decline. For example, the *Third International Mathematics and Science Study* (as cited in AMSTI, 2000) conducted by the United States Department of Education found the mean test score for United States students in the fourth grade was 545, and their peers in other developed countries scored a 529. For students in the eighth grade in the United States, their mean score was a 500, and their foreign peers scored a mean of 513. As the United States students advance in grade level, their math scores will decline. United States twelfth grade students scored a mean of 461, and their international peers scored a 500, a 39 point difference (AMSTI, 2000). While both international and United States students' scores decline, the scores show a greater discrepancy.

The *Third International Math and Science Study* (as cited in AMSTI, 2000) also found, while the United States continues to teach and reteach mathematics fundamentals

well past the fourth grade, education systems in other nations are introducing more advanced, more detailed, and more in-depth material. In addition, these foreign education systems are teaching by using more hands-on techniques than the United States.

While the situation is not good for the school children of the United States, it is even worse for the students of Alabama. Governor Bob Riley of Alabama may have had Dewey's comment, "Education and education alone spans the gap" (Hirsch, p. 18, 1999) in mind when he said in his inaugural address on January 21, 2003, "Our education system is not the world-class system our children deserve. Our economy is showing signs of weakness and a lot of people are disillusioned and are wondering if they could lose their job" (Riley, 2003, ¶ 22). The state of Alabama along with the rest of the nation was warned by the National Conference of State Legislatures to prepare the state for the demands that will be placed upon employees (Choate, 2000). More recently, the National Association of Manufacturers warned that the nation needs to improve the quality of education in primary, secondary, post secondary school systems, and in job training programs to provide the skilled workers manufacturers need. The manufacturers in Ohio are reporting with regularity that it is getting harder to find prospective employees who can read, write, and do advanced mathematics. The manufacturers report employees are in need of required skills for high tech manufacturing as well. This editorial stated that the challenges faced by employers in Ohio apply to Alabama employers as well ('Give students,' 2007). In yet another editorial, educators and employers are warned that Alabama's attempts to attract new jobs to the area will be hampered unless the state increases its efforts to train workers for the advanced skilled jobs that are required for employment in today's society ('Investing in,' 2008). Yet another warning was given by

a national business organization, the Enterprise Development, stating Alabama has not invested enough in education ('Give students,' 2007). In addition, the Arise Citizens Policy Project, a group of church and community groups, said Alabama could face a dismal future if it does not fulfill the needs for education and training required for today's job market. Arise stated that less than one-third of Alabama's workers have associate degrees or higher, and that by the year 2025, there will be a shortage of 100,000 college educated workers state-wide (Lyman, 2008). Alabama cannot even compete nationally in regard to high school graduates, for Alabama ranks far below the average for the nation of high school graduates. Thirty-three percent of Alabama citizens have no high school diploma. Alabama ranks 44th in college graduates and 46th in high school graduates nation-wide. Currently, most manufacturing plants require a high school diploma, and in five to ten years, they will require at least 14 years of education ('Dilemma: Poorly,' 1997). Bob Balfanz of Johns Hopkins has created a term, "drop-out factory", which he attaches to high schools in which at least 60% of the students who enter ninth grade at a school do not graduate. Nancy Pierce, a spokeswoman for Mobile County Public Schools in Alabama, said that in Mobile County they are trying to improve the middle schools so the students will be better prepared when they get to high school. She hopes the students will be better prepared for career and technical programs as well, in the event the students choose not to go to college (Zuckerbrod, 2007). Currently nine of fourteen high schools in Mobile County are drop-out factories according to Balbanzs' criteria.

Are the educational abilities of our work force really hurting the economy of the state of Alabama and minimizing its citizens' chances of obtaining employment? Certainly, since recently Toyota elected to put a new plant in Ontario due to the quality of the

Ontario work force and the lack of a quality work force in Alabama. Toyota even passed on financial incentives in the United States in favor of Ontario. Why? Reports state that the Japanese are not finding the quality of the workers required, as they are so poorly trained. The Toronto-based Automotive Parts Manufacturers Association stated that the work force in Alabama was so uneducated that the Japanese trainers who attempted to teach the employees their job had to resort to pictorials to teach the employees how to use the equipment in the plant (Krugman, 2005)! Automatic Screw Machine Products Company, located in Dothan, Alabama, must reject nine out of ten who apply for a job due to a lack of educational abilities. Many applicants cannot use a tape measure or add a column of numbers. The president of the company, George Strohm, reports that it amazes him how many job applicants do not know the answer to, what is 10% of 100? Mr. Strohm has said if an applicant has basic math skills, then he has the skills needed for his company, but many applicants do not ('Dilemma: Poorly,'1997). The picture is also bleak if college-educated applicants are required. Quales Corporation of Huntsville, Alabama, had 16 opening for engineers and not one resume was presented. The demand for higher skilled workers is increasing rapidly. During the National Conference of State Legislatures, state representatives were warned to prepare their state for tomorrow's demands upon employees. More jobs require math skills, and many jobs require advanced technology abilities as well ('State's future,' 2000). Currently, both China and Russia are graduating two times as many engineers as compared to the United States (Choate, 2000). Huntsville, Alabama, will not be the only portion of the state with a lack of qualified applicants if Alabama does not invest in the education of the youth. The editor of the *Mobile Press Register* says the lack of qualified workers will spread like a

plague ('State's future,' 2000). Greenes (1995, p.89) states, "the number of low-level mathematics training programs is growing exponentially, while, concomitantly the need for technologically, scientifically, and mathematically literate workers is on the increase." The Arise Citizens Policy Project agrees, stating that current and future employees must be able to meet the requirements of future demands placed upon them, and there should be policies in place to see this through to fruition (Lyman, 2008). Choate (2000) wrote in an editorial to the *Mobile Register* that Alabama is lagging behind, according to the legislative conference, and it is "below average when it comes to preparation for an economy based on knowledge, innovation and technology" (p. B 1). Choate said the uneducated already have fewer opportunities, and it will only become more difficult for them as an educated work force is demanded by employers.

On April 26, 1983, a committee appointed by the Reagan administration released *A Nation at Risk.* The committee discovered that test scores were falling and schools were expecting and accepting less from our students. To compound the embarrassment, students in other parts of the world were out-performing the students in the United States (Coeyman, 2003). However, the news is even worse for students in Alabama. A comparison of fourth grade math scores compared to their peers across the nation finds that Alabama fourth graders are not doing as well as their peers, and the gap appears to be widening. Test scores for 2000 found the national average was 224 and 217 for Alabama students. Test scores for 2003 found a national average of 234, and 223 for Alabama fourth graders. The 2005 scores only increased the gap, as the national average was 237 while Alabama students scored 225 (National Center for Education Statistics, 2005). Perhaps the most commendable thing *A Nation at Risk* did was to create talk about

education that was needed to address real concerns. As a result of *A Nation at Risk* George H. Bush made schools accountable to a national standard. In 1989, George H. Bush held a governors conference on education and on January 8, 2002, his son George W. Bush signed into law *No Child Left Behind.* While *A Nation at Risk* did get educators talking, it did not do anything to enact change. Gary Natriello, a professor at Columbia University's Teacher College, agrees. A group of educators, Koret Task Force, found there were fewer teachers qualified in their subject field than there were in 1983. Students reportedly are doing less homework, and the school year is shorter. However, Jack Jennings of the Center of Education Policy would disagree. He believes *A Nation at Risk* created an urgency that has resulted in change (Coeyman, 2003). *A Nation at Risk* stated that curriculum up to grade nine should create a desire and interest in students to learn. It should develop problem solving and computation skills, and it should enhance the students' abilities. However, in high school, the mathematics curriculum should "...equip graduates to (a) understand geometric and algebraic concepts; (b) understand elementary probability and statistics; (c) apply mathematics in everyday situations; and (d) estimate, approximate, measure, and test, the accuracy of their calculations" (National Commission on Excellence in Education, 1983, p.2). In addition, it was noted a demanding math curriculum should be enacted for students not wishing to go to college (National Commission on Excellence in Education).

Recently, *Education Week Magazine* released a report, "Quality Counts 2008", in which it was discovered that Alabama eighth grade students scored at an 18.2 percent proficiency level when compared with their peers nationally. Nationally, eighth grade students average 31 percent proficiency in math (Singleton-Rickman, 2008). The Public

Affairs Research Council of Alabama found comparable information when they determined that the Mobile County Public School System in Alabama graduated only 63% of their students and the state average is 69% (Havner, 2008). Clearly, something needed to be done. Alabama students were underperforming, and Alabama was losing jobs and future revenue from business and employees. What could Alabama do to help itself? The Alabama State Board of Education members decided something had to be done, so they charged a committee of 38 members from the academic and business world to develop an initiative to improve math, science, and technology education. There was urgency as there was awareness that as the population aged, there would be a need for replacements for aging scientists, mathematicians, and engineers. As it stands, 50% of Alabama students are not meeting their greatest potential because females who are taking higher level math classes in high school fail to enroll in majors that are heavy in math in college (AMSTI, 2000).

Alabama Mathematics, Science, and Technology Initiative

Meanwhile, the AMSTI committee was listening to presentations about programs in effect in Minnesota, Louisiana, and South Carolina. They listened to presentations from a variety of sources, including those already in effect in Alabama. One point became apparent-if Alabama schools were going to be the consumers of an initiative, then Alabama teachers should be consulted regarding their needs and opinions. As a result, the largest survey ever undertaken of Alabama teachers was conducted.

What the survey found was fundamentally important. For example, there are 1.6 million computers in Alabama schools, yet only 20% of the teachers maximize the computer's potential regarding instruction. Perhaps that is because only 20% of the

teachers who have computers in their room feel comfortable using them. The survey also revealed that 10% of Alabama classrooms have no computers compared to 6% nationally. The percentage of Alabama students who use calculators every day is 26% compared to 57% for the rest of the nation. Teachers who were surveyed also reported that there were too many objectives to cover. Because of this, many teachers felt rushed to cover objectives and became frustrated. The teachers reported there should be a balance between stringent control and lax control regarding what objectives are to be taught (AMSTI, 2000).

One of AMSTIs' goals would be to increase desire and encourage children to increase achievement and participation in mathematics. One of the first things the committee did was to involve the business community in an active way. The Alabama Mathematics, Science, and Technology Education Coalition, Inc. (AMSTEC) was included. AMSTEC is comprised of business and education leaders. Their goal is to improve math, science, and technology in Alabama. AMSTI asked AMSTEC to identify what skills students need regarding math and science in the workforce, and offer suggestions as to how educators of Alabama could better serve the business community in regard to math, science, and technology instruction. As a result, AMSTEC suggested the following five skills that students should have upon entering the workforce: 1) the ability to allocate resources, 2) the ability to communicate with others, 3) the ability to evaluate information, 4) the ability to understand systems, and 5) the capability of utilizing technology (AMSTI, 2000).

Finally, on October 26, 2000, the AMSTI committee presented a report with their recommendations. Among the recommendations was the establishment of Mathematics,

Science, and Technology Education Resource (MASTER) sites throughout the state. These sites would be used for collaborating with local colleges and businesses, for accessing materials, and for providing professional development. The previously mentioned survey that was conducted found that teachers felt a need for resources, professional development, and technology. It was also decided that the teacher is the most important factor in the classroom and that there were already many good things going on in Alabama classrooms; it just was not consistent across the state. The survey also revealed that there are five components required for a good education. The first is that the math curriculum should not be overwhelming regarding the number of objectives that must be covered, but that math should be taught in depth to maximize understanding. Skimming across many objectives with little retention is far worse than learning fewer objectives with greater understanding. Second, hands-on inquiry-based instruction is better than other styles of teaching, and it results in students learning to problem-solve. Third, teachers need supplies, and the best way for AMSTI to implement this goal is to establish material support centers. Fourth, alternate assessments are valuable forms of assessments and can be used along with paper and pencil tests. Fifth, professional development is very important, and it should be relevant.

Statement of the Problem

Alabama eighth graders are among the worst in proficiency mathematics ability nationwide. Does AMSTI impact that situation in a positive way? Do teachers perceive that AMSTI is helping eighth grade students to become more proficient in math? Is there a relationship between AMSTI-trained mathematics teachers and mathematics scores on the SAT 10?

Research Questions

Are the SAT 10 math scores of students who are taught mathematics utilizing the methods endorsed by the Alabama Math, Science, and Technology Initiative higher than those of students not taught by that method?

Are the perceptions of teachers who teach mathematics utilizing the AMSTI methods positive?

Do the AMSTI teachers who teach math to students using this method believe it has increased their students' SAT 10 test scores?

Research Hypothesis

Eighth grade math students who have been taught utilizing techniques of the AMSTI method will show higher scores on the math portion of the SAT 10 than the previous year's eighth graders at the same school who were not taught mathematics utilizing the AMSTI method.

Definition of Terms

AMSTI- Alabama Mathematics, Science, and Technology Initiative- a state-wide initiative to get all schools in Alabama to teach mathematics, science, and technology utilizing a direct, hands-on approach

ARMT- Alabama Reading and Math Test, held each spring. For many of the test problems the students must explain how they arrived at the answer they gave.

Inquiry based learning- hands-on approach to learning

Concrete operations- addition and subtraction are examples of concrete operations

Constructivist learning- the learner creates his own knowledge by self-paced learning; he discovers his knowledge (Hirsch, 1999)

Cooperative learning- to divide students in a class into groups so they can cooperate together and solve a problem or an assignment together

Critical-thinking skills- "a phrase that implies an ability to analyze ideas and solve problems while taking a sufficiently independently 'critical' stance toward authority to think things out for oneself" (Hirsch, 2000 p. 247)

Developmentally appropriate- a position that states there are certain best times to teach a child something, when his brain is developmentally able to handle it (Hirsch, 2000)

Dewey, John- 1859-1952 – an innovator in education for his laboratory schools in which children learned by doing practical skills that would help them in life.

Discovery learning- "the teaching method which sets up projects or problems so that students can discover knowledge for themselves through hands-on experience and problem-solving" (Hirsch, 2000, p. 250)

Hands-on learning- tactile approach to learning

Manipulative- used primarily in math, a student works with objects to understand the abstract concepts of mathematics

Multiple intelligences- Howard Gardner's theory that there are eight areas of intelligence and a child may excel in any of the eight areas.

Performance-based assessment- students are graded on how well they solve a problem they might encounter in the real world

Piaget, Jean- 1896-1980- widely respected for his studies on how children come to know

SAT 10- Stanford Achievement Test a nationwide assessment given to children. For this research we are concerned only with the eighth grade assessment of mathematics on the SAT 10.

Summer Institute- a two-week workshop held by AMSTI to teach mathematics teachers how to utilize the AMSTI approach to teaching math

Teaching for understanding- a teacher will cover less material but the material covered is taught in such depth the child has a greater understanding of the material

Theory- "In general a 'theory' is an orderly integrated set of statements that describes, explains and predicts behavior" (Costley, 2006, p. 1-2)

Delimitations

This research was conducted upon teachers and eighth grade math classes in Alabama public schools. Only randomly selected eighth grade SAT 10 math scores of schools that meet the criteria of having 80% of their math and science teachers trained in AMSTI methods were utilized.

Only those teachers who have attended one or more Summer Institute of AMSTI training were surveyed.

Assumptions

Several assumptions seem appropriate. First, those who chose to complete the survey were honest in their responses. Further, the information given by the directors of AMSTI was accurate. In addition, the information on the AMSTI web site was accurate. Finally, there is an assumption that those employed by AMSTI and the teachers who have been trained have a genuine interest in improving mathematics education for the students.

Justification

Alabama eighth graders consistently score lower than their peers in other states on mathematics assessments. Nancy Pierce, an employee of the Mobile County Public Schools stated that the Mobile County Public School System is in the process of trying to

improve the eighth grade test scores, because it is hoped if the eighth graders have a good foundation they will be less likely to drop-out later (Zuckerbrod, 2007). Alabama is losing jobs, and businesses are having a difficult time hiring qualified employees. As a result Alabama is losing tax revenue which it could use to the benefit of all of its citizens. AMSTI had a budget of 22 million dollars in 2007 and a projected budget of 35.8 million dollars for 2008. It is important to see if the money spent is giving a measurable return. Why is this research necessary? Governor Bob Riley, a big supporter of AMSTI, said it best in his inaugural address on January 21, 2003:

> I see an Alabama full of hope, promise and opportunity. A state where our children are never forced to leave their home state for good-paying jobs; where other states look to us for guidance on creating a superior education system; where our work force is so well-trained and so committed that industries throughout the world are knocking on our doors; where we use innovative skills to create a new economy for the 21st century.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

The value of a good education cannot be disputed. Thomas Jefferson believed that government would benefit by an educated society. An educated people were more likely to discover corruption or dishonesty in the government. Educated people could be valuable in ensuring the government remained honest. Horace Mann agreed with Jefferson saying a common school would allow all children an education and that would enable them to be independent and free (Hirsch, 1999). Jean Piaget took a slightly different spin when he said, "education means making creators... you have to make inventors, innovators, not conformists" (Bringuier, 1980, p. 132).

Jean Piaget

Piaget was born in Switzerland in 1896. He was a precocious child as he was first published at the age of 10. While still a child he worked in his hometown museum as a specialist in malacogy, a specialist on mollusks, and was eventually offered the director's job which he turned down in order to go to college. However, his interest in biology remained, and as a result, Piaget viewed biology as having an answer for everything. He was enamored with the idea of a biological explanation of "how we come to know" what we know. Piaget realized he would need more education in psychology which he obtained in order to delve into the mind. Yet, his whole life he considered himself a biologist interested in genetics. It was Piaget who coined the phrase, "genetic epistemology;" or, "how we come to know" (Pulaski, 1971). He believed what makes humans different from animals is their ability to reason in an abstract manner (Huitt & Hummel, 2003). Initially, Piaget was not well regarded because he used few subjects and

he had no statistical validation for his beliefs. During the 1950's educators in the United States began reevaluating his writings (Pulaski, 1971).

Piaget studied the formation of a child's knowledge. Piaget believed it was important to "identify the intervening factors-those due to external experience, social life, or language and those due to the internal structure of the thinking subject, which is constructed as it develops" (Bringuier, 1980, p.19). Piaget said of constructivism:

> Knowledge is neither a copy of the object nor taking consciousness of a prior forms predetermined in the subject; it's a perpetual construction made by exchanges between the organism and the environment, from the biological point of view, and between thought and its object, from the cognitive point of view. (Bringuier, 1980, p. 110)

Constructivism is a descriptor. It is intended to aid us in an understanding of how people learn. This learning is accomplished by a variety of activities and things that infringe on our environment. Some of these infringements are subtle, some are tactile; some are social, while others are biological. This tells teachers little about what they should do, but does tell them what they should not do. Accordingly, teachers who feel they are in control of a child's learning would be mistaken (Towers & Davis, 2002).

Piaget also makes a point so obvious it is often over-looked. He believes for a child to solve a problem he must be interested in the problem; it must interest his affective motivation (Bringuier, 1980). According to De Lisi, (2002, p. 7) his interpretation of Piaget's ideas regarding student learning occurs when a student is actively engaged in learning. This learning happens when "(a) she feels her learning efforts are respected and valued by teachers and classmates, (b) she has a positive feeling about the learning situation, and (c) the curriculum tasks and problems are developmentally appropriate."

Developing knowledge happens when a child uses his current cognitive abilities to tackle a particular task or problem according to Piaget (De Lisi, 2002). Piaget also stated, (Bringuier, 1980, p.19) in the study of how children learn, "...you must constantly identify the intervening factors- those due to external experience, social life, or language and those due to the internal structure of the thinking subject, which is constructed as it develops." Piaget believed that education needed to be transformed, but he felt his place as a psychologist was to "give facts the pedagogue can use and not put oneself in his place and give him advice" (Bringuier, 1980, p. 131).

Piaget's ideas have come under attack but his ideas are still highly regarded by many. Bjorklund wrote in his article "In Search of a Metatheory for Cognitive Development (or, Piaget is Dead and I Don't Feel So Good Myself)" (1997), that the reason Piaget is still respected is due in part because his ideas were genetically based. Piaget knew a child was able to grasp more complex ideas as he matured. Bjorklund is in agreement with Piaget in that he advocates a metatheory seeped in developmental biology. He believes if one can understand brain development then one can optimize a child's learning potential-to teach when the brain is able to handle the information. Is it true the earlier one tries to teach a concept the better? Probably not according to Bjorklund; it is better to wait until the brain is mature enough to handle the concept.

According to Piaget, the first thing children need to do is explore their environment, to explore the external world (Edwards, 2005). Piaget believed children have a desire to learn and children will create structures to deal with the environment around them. Children interpret their environment based upon the structures they have created (Costley, 2000). He also thought as a child becomes more intelligent it allows the child to

move from concrete to more abstract reasoning and understanding (Fogarty, 1998). Piaget said children grouped ideas and learning into schemas and future learning was built upon the foundation of a child's schemas (Ediger, 1999). Schemas, or mental organizations, help a person to plan an action. At birth these schemas are reflexes as they mature they become constructed schemes. As one ages we use assimilation and adaptation to deal with the environment. Assimilation is taking what is in the environment and placing it in existing cognitive structures. Accommodation is when previously known structures are changed to accommodate something new (Huitt & Hummel, 2003). Piaget thought concrete operations began about age seven. Examples of concrete operations would be addition or subtraction. Prior to concrete operations the child possesses sensory-motor intelligence. Symbolic play and mental images are examples of sensory-motor intelligence (Bringuier, 1980).

Piaget noticed smaller children would answer questions differently than older children because they thought differently than the older children, not because they were not as smart (Huitt & Hummel, 2003). Piaget felt children use cognitive structures to make connections according to developmental levels (Piaget, 1973). Babies are born with reflexes but as they mature they develop constructed schemas (Huitt & Hummel, 2003). According to Piaget, children regardless of who they are "go through an evolution of intelligence that is always the same." He said it was the same because "each stage is necessary to the following one. It's called sequential order" (Bringuier, 1980, p.3). Piaget qualified his use of stages for child development by saying the order of the stages should be successive, integrated, and continue towards the next stage. The structure once acquired tells one every operation it will cover and each stage has a level of preparation

and completion. Structures may lag both horizontally and vertically. A horizontal lag is one that can apply to something else. A vertical lag is reconstruction of a structure by other means (Piaget, 1973). Piaget stated, "Knowledge is an interaction between subject and object, and I think the subject cannot be locked in by a structure given once and for all" (Bringuier, 1980, p.19). He said the person constructs his knowledge (Bringuier, 1980).

Piaget is long remembered for his stages of cognitive development of which there are four. The first stage is the sensorimotor stage. During this stage the child is an infant. There is no use of symbols. The child is developing knowledge generated from experiences and interactions with people and the environment. The child becomes more mobile, has object permanence, and develops a small amount of language. The second stage of development is the pre-operational stage. This stage lasts up to early childhood. The child's language improves and there is development of imagination. The child is very egocentric, and his thinking is not very logical. The third stage is the concrete operational stage. This stage lasts from school age to early adolescence. The child becomes less egocentric, and symbols are used for concrete objects. The final and fourth stage is the formal operations stage. This stage is from adolescence to adulthood. Symbols can now stand for abstract ideas. The egocentric child may return to the adolescent child. Most children do not think formally until adulthood, if then (Huitt & Hummel, 2003).

Piaget's stages play a very important role in the math education. The "new math" was a direct result of his theories (Pulaski, 1971). Piaget's stages of development affect the child's abilities. He believed during the concrete operational stage the child should be able to do simple operations with whole number systems. During the formal operations

stage the child should be able to do proportions and to reason using two reference systems (Piaget, 1973). Ediger (1999) used Piaget's four stages to create these guidelines for teachers of mathematics:

1. the teacher must study the maturational levels of pupils in order to know what and how to teach these learners.

2. there can be much wasting of time in teaching what the maturational level of the involved pupil is ready for. Then too, the teacher must teach what the maturational level of the pupil is ready for in mathematics. Otherwise time slips by without the learner attaining as much as possible.

3. hastening the readiness of a pupil for learning mathematics does not work. The maturational level will indicate what can/cannot be taught.

4. there needs to be an adequate amount of concrete materials available for teaching since through the age of eleven, the stage of concrete operations is still in the offing.

5. securing attention for learning is salient since learners do not achieve unless they mentally operate upon the content being presented. (p. 15)

Lev Vygotsky

Piaget had a contemporary named Lev Vygotsky (1896-1934). He was a Russian psychologist who was working the same time as Piaget to ascertain how children learn. One common approach Piaget and Vygotsky both utilized was the interview technique with children. They both felt a teacher could have discussions with the child to gain an understanding of how much the child could do, and how much assistance would be required of the teacher (Greenes, 1995). The difference between Vygotsky and Piaget was the importance placed upon social interaction by Vygotsky. He believed this was a

major influence of cognitive growth. He felt language development to be the most important component for a child's development (Costley, 2006). Vygotsky's belief was that the community in which a child lives will have its own history and beliefs and the child will come to understand these beliefs and customs by communication and symbolism. In Vygotsky's view a child does not construct this on his own, but rather with siblings or others in his environment (Edwards, 2005). Vygotsky felt once a child had interaction with others, then the child would internalize it to form an understanding (Fogarty, 1999). Vygotsky stated there were cognitive and social constructivisms. The cognitive constructivism is how one understands and the social constructivism is how understanding comes through social interactions. It was Vygotsky whose theory of "zone of proximal development" embraced the social construct. He found students who worked by themselves rarely did as well as those who worked with an adult. The adult acted as one who guided the child to a sense of refined, more effective thinking (Atherton, 2005).

Vygotsky espoused two levels of a child's development: first, what is known now, and second, what knowledge is maturing. He knew knowledge for a child was limited by a child's mental functioning, and the ability to grasp ideas was determined by this (Greenes, 1995). Vygotsky knew the key for the teacher was in knowing a student's zone of proximal development so one could see what step should follow for the child in his development. The teacher's job would be to enter into dialogues with the student until the student comes to understand the material as well as the teacher understands it. Constructivism is about the learner being actively involved in learning. It is a joint effort between the teacher and pupil (Atherton, 2005). Ediger reminds teachers that with an

understanding of psychology they are better able to serve the students, and that a teacher must be mindful of a child's individual differences for optimum learning.

Howard Gardner

According to Piaget-inspired Howard Gardner, born in 1943, school used to be a place where teachers were perceived to be the ones who poured knowledge into a child. Currently teachers are more likely to be placing children in a position where the children are able to construct their own knowledge through experiences. Howard Gardner is best known for his "theory of mind" which states there is no way to teach children all they need to know or all they will ever need to know as they mature. As society progresses it is important to give children the tools they will need to access information on their own and be able to critically think about it. Theory of mind allows a child to collaborate and consider others opinions; therefore, social maturity is important. Theory of mind is also crucial in a child's ability to scientifically reason and acquire critical thinking skills. Howard Gardner's concept of theory of mind is important to educators because it focuses on how children think about thinking. The concept of the theory is that people will do what they need to in order to obtain their desires, despite their beliefs.

The mental landscape is different than the physical landscapes which are the actions and events. To find meaning in actions, the mental landscape is necessary. Once children realize there is a mental landscape, theory of mind has evolved. This discovery by the child happens while the child is still quite young. Some researchers actually think the child is born with the theory of mind, and others that children construct it from their own experience (Astington, 1998).

Gardner is also noted for his belief that a child has eight different intelligences. These intelligences are the intrapersonal, naturalistic, interpersonal, verbal, bodily, visual, mathematical, and musical. With these intelligences children are able to resolve problems, according to Gardner. Utilizing knowledge of multiple intelligences means the teacher will tune in to the specific intelligences a student has and use those intelligences to teach the child. Eight intelligences are not used for every lesson, but several intelligences may be utilized for a single lesson (Fogarty, 1998). "Where individuals differ is in the strength of these intelligences – the so called *profile of intelligences* – and in the ways in which such intelligences are involved and combined to carry out different tasks, solve diverse problems, and progress..." (Gardner, 1991, p. 12).

Some may consider John Gardner's belief about Piaget an exaggeration when he said Piaget's main achievement might be that of a scientist who developed a "deep understanding of what it means for a creature to be numerate and that his view of human development centered upon the capacity of our species to achieve sophisticated knowledge about numbers – or Number" (Gardner, 1991, p. 29). However, Gardner does take exception to some of Piaget's beliefs. First, he disagreed with Piaget's belief that "development consists of a series of qualitative shifts in representation and understanding" (Gardner, 1991, p.28). This does not happen for everyone argues Gardner. Second, Gardner disagrees that each successive step is directly tied to the preceding step. Third, Gardner said Piaget thought, "understanding of numbers lay at the center of intellect" (p.29). Finally, Gardner does not agree with Piaget that a child's earlier conceptions of knowing were eliminated as a child came to know on a more

advanced level. He believed those views could reemerge later when appropriate (Gardner, 1991).

John Gardner believes the United States could lead the world in a new education goal, one in which our children would understand what they were being taught. He suggests two mandates for our educational system: first, find out what reforms are working and figure out how they might work in other areas of education; second, identify conceptions and practices that highlight stages of understanding. This should come from various groups and individuals. Then design a curriculum which uses these concepts (Gardner, 1991).

John Locke

John Locke was somewhat in agreement with Gardner as he believed the outside world imprinted ideas upon the mind. He also said the mind was like a blank tablet. Once the simple ideas were written on the tablet of the mind, then conscious thought takes those simple ideas and constructs ideas of greater magnitude (Oxford, 1997).

John Dewey

John Dewey, was also working during some of the same years Piaget was to make education meaningful to the child. Dewey was influenced by William James and his *Principles of Psychology.* Dewey created a laboratory school at the University of Chicago to study inquiry based learning with his 100 students (McDermott, 1981). He worked to make education meaningful to the students. The school had gardens, laboratories, shops, and playfields (Dewey, 1990). Dewey said if the material presented for the child's education is not meaningful, three evils will result. First, the material will be formal and

symbolic; second, the material will create a lack of motivation; and third, the material loses its quality becoming something to memorize then forget. This happens because the child's mind is not ready to accept it, and he does not have the ability to generalize the information (McDermott, 1981). Dewey believed that education should represent life for the child, his neighborhood, his playground, and it should continue and expand upon what the child has already learned at home prior to coming to school. Since that was not the process of education at that time, many attempts at educating children failed. If education is given, then it is not educative. Dewey said the education process remained the same due to sentiment and he called that "no greater evil" (McDermott, 1981, p. 452). He also said, "Only by being true to the full growth of all individuals who make it up, can society by any chance be true to itself" (Dewey, 1990, p. 7). Dewey believed what a parent wants for a child in school is what should be provided, not just for his child but for every child in the community. To not do so could jeopardize our democracy (Dewey, 1990). Dewey believed for education to occur, two things must be known by an educator. First, education is not primarily cognitive; it is active-passive. Second, the value of the learning experience for the child depends upon how much the learning experience is based upon that which is already known by the child. He said it was unrealistic for a teacher to believe that a child who must be active should remain quietly seated while the teacher presents a lesson. The separation of the mind from the body in educating children was "evil." He knew the child was a social being and to eliminate the social aspect of a child's being would be a mistake. "Education, therefore, must begin with a psychological insight into the child's capacities, interests, and habits" (McDermott, 1981, p.445). Since children are active and like to create situations where something will happen, Dewey felt

it best to channel that energy into learning. "Through direction, through organized use, they tend toward valuable results instead of scattering or being left to merely impulsive expression" (Dewey, 1990, p. 36). He believed in inquiry-based learning because, "An ounce of experience is better than a ton of theory simply because it is only in experience that any theory has vital and verifiable significance" (McDermott, 1981, p. 499). Dewey believed direction of students' activities could lead to lessons learned. It was important to Dewey that teachers not overlook lessons taken from nature, or from that which is around the children on a day-to-day basis (Dewey, 1990). For example, a lesson about a store would be useful and necessary in the child's life. Dewey was in favor of leaving the classroom and falling into experiences and field studies. Dewey would love the idea of the field trip (Fogarty, 1999). Dewey cautioned educators to remember not all experiences are educative. It is the quality of the experience that should be considered. The teacher should evaluate the child's experiences to see the direction one is headed. If experience creates curiosity, then it can motivate one to travel through deeds not as interesting if one realizes it is part of continuity or a means to an end. Dewey had what he called "theory of effort." It was based upon the realization that at that time, most educators thought if learning was hard for the student, then once learned, the knowledge had more value. This was not a good way to teach because he felt the minute the child could divert his attention to something more interesting he would. In the meantime, the child could become very adept at looking busy, not necessarily being busy. He said, "It substitutes the impure interest of fear of the teacher or hope of future reward for pure interest in the material presented" (McDermott, 1981, p. 424). Interesting lessons for the children were the goal, because if the lesson was interesting, the child would be attentive

and would realize the worth of the material. There is a union of the object and the subject, according to Dewey, when a lesson is interesting. Dewey felt if the energy spent trying to make a child behave and not fidget in his seat was used to make a lesson relevant to the child, the education process would be much better (McDermott, 1981). Dewey believed the current state of education at the time was that it separated the mind from the object. This yielded a failure of students to connect, and it caused one to restrict what was significant.

> We get so thoroughly used to a kind of pseudo-idea, a half perception, that we are not aware how half-dead our mental action is, and how much keener and more extensive our observations and ideas would be if we formed them under conditions of a vital experience which required us to use judgment: to hunt for the connections of the thing dealt with. (McDermott, 1981, p. 499)

Dewey believed when someone tries and fails at an activity it is because there are missing links. We analyze, we observe, we try again. It causes us to think of connections so that the occurrence becomes understood (McDermott, 1981). Dewey stated that learning the way it was currently being conducted was remote and shadowy when it was compared with completing a project that had a real purpose and motive (Dewey, 1990). As far as mathematics was concerned, John Dewey felt math should be about what is important to the student and society. It should revolve around real-world examples. He also thought children would rather work together as a group than alone, and it should be active as opposed to passive learning (Ediger, 1999). Math, according to John Dewey, means several things. The teachers of math should first and foremost understand the students are the main concern of the curriculum, and second, the curriculum should stress

life-like problems. Third, it should be inquiry-based, and the problems should have purpose and merit to the students' lives. Finally, the role of the teacher is to help students find their way to the solution (Ediger, 1999). Dewey said for a teacher to be effective he should first become acquainted with the materials, exercise ingenuity, be patient, be persistent, stay alert, and have discipline (Dewey, 1990). Hackenberg and Lawler (2003) state that the kind of liberation found in a constructivist classroom is not only in harmony with Dewey's ideals but is an opportunity for the teacher to make choices, and that is very liberating and less constricting than being controlled by outside forces. Furthermore, Dewey wanted educators and lawmakers to know, "all reforms which rest simply upon the enactment of law, or the threatening of certain penalties...are transitory and futile" (McDermott, 1981, p. 452).

Piaget had his own directive regarding educating children: "Education means making creators...you have to make inventors, innovators, not conformists" (Bringuier, 1980, p. 132). How is this done? One of the first steps should be for a teacher to put aside her remembrances of how math was learned and instead concentrate on the student's abilities. The teacher can become a liberator for the student and herself. The student can travel his own path to knowing, unencumbered by the path previously traveled by the teacher. Hackenberg and Lawler (2003) think the more self aware someone is, the more likely he is to be able to see others as autonomous individuals. The greater ability to step out from oneself and observe the better able one is to identify one's own thoughts and ideas. Ethics should also be present in a constructivist classroom. Ethics determines how important it is for the teacher to exert her will into the lesson. The teacher should be aware there are times when it is mandatory for the teacher to retreat from the lesson and

give the children freedom to learn (Hackenberg & Lawler, 2003). The lesson plan is a tool utilized by teachers for many years, and teachers have been made to believe, once constructed, the plan should not be allowed to meander. However, Towers and Davis (2002) state the lesson plan is only anticipating occurrences and the actual structure of the lesson should be what happens once teaching has begun.

Contemporary Ideas

If a constructivist education plan for all is deemed appropriate, then it must start in teacher education programs. A study was conducted regarding student teachers and how they came to align themselves with different theories of teaching. It was found the methods courses taught in teacher education programs were more influential than previously believed. This was to the extent that the student teaching experience failed to change preconceived beliefs (Woolley S., Woolley A., & Hosey, 1999).

It is doubtful there are any teacher education programs that advocate rote memorization as the preferred method of teaching children. First, it is boring, and second, if learning involves active participation, students learn more, and rote memorization does not do this. The following methods have been rated by the Nondestructive Testing Resource Center from least effective to most effective regarding retention by the learner: 1. Lecture =5% 2. Reading =10% 3. Audiovisual= 20% 4. Demonstration =30% 5. Discussion group = 50%, 6. Practice by doing =75%, 7. Teach others/ immediate use of learning = 90%.

Wiggins and McTighe (2001) suggest a backward design for curriculum. This is accomplished by deciding what the learning outcome should be and then designing the process to arrive at the destination. The authors find the students actually perform better

when they have advance knowledge of the goal to be reached. Their argument for backward design is "we are not likely to achieve our target of understanding unless we are explicit about what counts as evidence of understanding" (p. 39).

Wiggins and McTighe (2001) suggest instead of covering a lesson the teacher should help students to uncover a lesson. This is accomplished by allowing the student to uncover the knowledge for himself, thereby gaining an understanding of all the nuances and efforts required to arrive at the information. They suggest eight techniques to help a teacher arrive at allowing students to uncover their knowledge. First, use the textbook for reference purposes; second, answer fewer questions and ask more questions; third, reverse roles- the teacher asks the naive questions and requires the students to explain the material to the teacher; fourth, an understanding by the students in which there are no stupid questions; fifth, ask questions that allow for more than one acceptable answer; sixth, coach the students to present what they have uncovered to others in the class; seventh, create autonomy amongst the students; and eighth, assess regularly.

Wiggins and McTighe (2001) realize that sometimes a student will give a teacher a wrong answer when utilizing discovery-knowledge such as this, but a wrong answer often illuminates a student might have a greater understanding when the teacher is allowed to question how the student arrived at the answer. Often the teacher can come to an understanding of how much the student does know information that could not have been discovered in a multiple choice test. If all that is required of a student is a correct answer, it stops the student from investigating questions that naturally arise. A student should be allowed the chance to find out knowledge for himself.

Peer-learning could easily be tied into Wiggins and McTighe's ideas about uncovering knowledge. Piaget believed that children are able to learn based upon what they have experienced in life. Children bring past peer-learning experiences with them to new peer-learning. One thing the teacher should do to make peer-learning successful is to take the time to learn how their students feel about peer learning and address any concern the students might have. The ultimate goal is for the students to become independent thinkers who can express their ideas well. This can be readily accomplished when the teacher is able to step back from the peer-learning situation and children are allowed to reinvent rules. When children are less concerned about producing an answer that will please the teacher, true learning can occur. When students are able to explain to another student the material, gaps in understanding can be corrected. De Lisi (2002) adds:

> The underlying idea is that student achievement will be enhanced when peer activities are part of the instructional process. The main purpose of using peer learning in schools is to sharpen academic skills such as listening and communication, and to enhance subject matter mastery by promoting deeper levels of understanding based on discussion and a free exchange of ideas. (p. 5)

When peers work together, learning is enhanced. Listening to peers and exchanging ideas creates a deeper level of understanding. Listening skills and learning to be a contributing team member are also benefits. De Lisi (2002) also believes if peer learning is to be successful and learning is to occur, then the teacher has the obligation to provide well-thought-out and well-constructed lessons. If this is done, then the students are able to proceed through the learning process. If the students are diverted from the lesson due to an obstacle which the teacher had not considered, then the students will become

unhappy and the lesson will not be as effective as it might have been. A child is truly engaged in the lesson when he feels valued by his peers and teacher, when he feels good about the learning situation, and when the task at hand is age/grade appropriate (De Lisi, 2002).

Robin Fogarty (1998) suggests creating an intelligence-friendly classroom. She targets eight steps for the creation of an intelligence-friendly classroom. In the intelligence-friendly classroom, learning should be in a safe and stimulus-rich environment, and skills that will be needed throughout life should be taught. This classroom should host that which will create a development path for the student to progress, it should be full of constructivist foundation, and multiple intelligences should be used in the lesson. Further, there should be time for students to reflect on what has been learned, and there should be more than one form of assessment utilized. With regard to assessments, all students do not always find the same answers, but if a teacher tries to ascertain how the student got to an end-point, a teacher can find out what the child has learned and acknowledge it, while illustrating the value of what the child has come to know (Hackenberg & Lawler, 2003). When lessons are taught using varying methods, then assessed using a variety of methods, it is better for the student (Gardner, 1991).

Wiggins and McTighe (2001) believe there are six facets of understanding. These are the ability of the child to explain with facts and data, to interpret and make information understandable to others, to apply what has been learned to other experiences, to critically interpret others' opinions, to empathize with others who might have varying opinions that will not produce any value, to have self knowledge of what we do know and realize what we are unable to understand.

Goldman and Hasselbring (1997) believe if students understand the "how and why" of a mathematics procedure, "they will be able to store it as a part of their knowledge network, thus developing links with other pieces of information" (p. 201). When the three types of mathematical knowledge are linked there is the possibility of transference of knowledge to other areas.

Student assessment has been the bane of many an educator and school administrator. William Heard Kilpatrick created a teachers' college during the 1920's. One of the first things he did was to choose a no-test, no-grade format. He felt grades sent messages that some students were better than others, and it was unfair to label students with letters (grades) and numbers (test scores). He felt the grade-test approach created competition rather than learning for learning sake. Also, graded assessments, he believed, were the result of material soon forgotten (Hirsch, 1999).

Howard Gardner would have agreed with William Heard Kilpatrick, as he says that testing has been criticized for some time, yet it seems to have gained in popularity. The argument seems to be that the assessments provide a good indicator of who should be able to do well in college. Gardner says, "formal testing has moved too far in the direction of assessing knowledge of questionable importance in ways that show little transportability....quite different forms of assessment need to be implemented if we are to document student understanding" (Gardner, 1991, p.134).

Current types of assessments do not do an adequate job. Assessment should be ongoing and based on a child's current ability (Greenes, 1995). Too often teachers fail to produce other forms of assessments. However, assessments that are both informal and formal have value. A teacher should be free to check for understanding in assessments

other than in pencil and paper tests (Wiggins & McTighe, 2001). Additionally, there should be a way to assess a student in collaborative work. Since a child may come to an answer in a round-about manner, strategies to be used by the teacher might include discussions or performance tasks to check for understanding (Greenes, 1995).

John Dewey is another who had little use for examinations. He stated, "Examinations are of use only so far as they test the child's fitness for social life and reveal the place in which he can be of the most service and where he can receive the most help" (McDermott, 1981 p. 447).

Today, different forms of assessments are being attempted in some areas of the United States. Vermont is using portfolio assessments. California is trying performance-based assessments. Students are completing projects which illuminate their understanding of real-life problems and solutions in math (Gardner, 1991).

Wiggins and McTighe (2001) suggest the three ways to assess students' understanding of mathematics. First, students should be able to not only solve the problems but transfer the knowledge to more complex problems. The student also must possess the knowledge to solve the problem correctly and in a creative manner. Finally the presentation of the solution by the student should be well-constructed and interesting to his audience.

One of the recommendations made by *A Nation at Risk* is that the eighth grade curriculum should provide a good base for high school and should create an enthusiasm in the students to want to learn. This curriculum should also enable the students to develop their skills and talents. *A Nation at Risk* also states technology should be utilized, coupled with the latest strategies in educating the students (National Center for Education Statistics, 2005). "When you use technologies such as calculators, spreadsheets, and

graphing and modeling programs, you help students as they develop their understandings" (Sherman & Kurshan, 2005, p. 39). It is understood that the student who is interested is more likely to learn than one who is not. "Lack of interest is the number one reason students give for not learning mastery" (p. 11). Then what is the most effective way to get eighth graders on track to being successful high school mathematics students? How can their interest be not only held but captivated? Perhaps the answer lies in an initiative begun in the state of Alabama, AMSTI, or the Alabama Mathematics, Science, Technology Initiative.

Orlich (2000) suggests that more inquiry-oriented activities might help to raise test scores. Meanwhile, a sixth grade teacher named Jay Simser in Iowa says that concern about test scores has undermined the quality of teaching. He says the test score debate has taken the artistry out of teaching (Coeyman, 2003). How can educators regain control of the classroom, while at the same time increasing the all important test scores? AMSTI may be the answer for both Orlich and Simser. AMSTI is a state-wide initiative begun in Alabama designed to improve students' comprehension of mathematics, science, and technology. At its core is the idea that inquiry-based learning will not only aid in this endeavor but will also increase test scores. "The idea that students will learn better if they see, feel, and touch the subjects they are studying has such obvious merit that it would be quite amazing if traditional education did not make use of multisensory methods of teaching" (Hirsh, 1999, p.9). Combining inquiry-based learning and peer or cooperative grouping adds another dimension to the learning process. Piaget said in developing knowledge the child brings his current cognitive abilities to the task at hand. Envision two or more children in a group working together to solve the same problem, each with

their own knowledge to aid in solving the problem at hand (De Lisi, 2002). Piaget said it best with regard to mathematics education when he stated:

> As for modern mathematics taught to children, in that case there is an astonishing convergence with what we have learned in psychology....absolutely nothing is done to teach the child the spirit of experimentation. He has lessons, he sees experiments demonstrated; but seeing them is not the same as doing them for himself. I'm convinced that one could develop a marvelous method of participatory education by giving the child the apparatus with which to do experiments and thus discover a lot of things by himself. Guided, of course. But in fact it would have to be a professional who could see how this would work in practice. (Bringuier, 1980, p. 131)

The Alabama Math, Science, and Technology Initiative Inception

The initial committee that was charged with developing a program to help Alabama students increase their knowledge of mathematics may not have had Piaget in mind as a mentor when they began, but perhaps without realizing it he became one by proxy.

For three years prior to the actual initiation of the AMSTI program, 400 people selected resources and worked on guides for the Summer Institute trainers. Additionally, 500 Alabama teachers were surveyed in order to ascertain what they thought they needed in order to make mathematics education successful. This was the largest teacher survey ever conducted in the state of Alabama (AMSTI Overview, n.d.).

The Alabama Department of Education initiative to improve mathematics includes grades K-12. Also included are teachers and local school administrators. In order to be an AMSTI school, 80% of the math and science teachers must agree to participate in a two week paid summer institute for two consecutive years (C. Jones, personal

communication, February, 19, 2008). The teachers are taught by AMSTI trainers ("Frequently Asked Questions, AMSTI, n.d.). "'The teachers get to experience it as if they were the students,' said Beth Hickman, the Auburn University site director of AMSTI" (Harvey, 2007, p. B 1). The following fall after the summer institute, modules of supplies are delivered to the teachers who participated in the summer institute. There is no cost to the schools for the modules, and at the end of the school year, the modules are returned to AMSTI, where they are refurbished and delivered back to the teacher for the coming year (Frequently Asked Questions, AMSTI, n.d.). At the Summer Institute teachers are grouped by grade level and subject matter and trained by master teachers who have themselves been trained by AMSTI. The AMSTI training is aligned with state and national standards. It is inquiry-based, hands-on, and research-based. During the following school year, AMSTI provides mentoring and support to local schools, and AMSTI specialists periodically visit the AMSTI schools. In addition, each school has learning teams in which teachers meet to address concerns regarding implementation of AMSTI. AMSTI schools also receive two days of professional development each year (Overview, AMSTI, n.d.).

Deanna Crews, a sixth grade teacher at Millbrook Middle/High School said, "It covers many areas in the Alabama Course of Study. AMSTI feeds straight into the problems on the ARMT test. Students have to explain their process of thought on the ARMT, and are graded on how well they explain how they arrived at the answer" (Mosely, 2005,¶ 13). Russell Robinson, a special education inclusion teacher at Sanford Middle School, believes the hands-on approach will work well with his special needs children. He also thinks AMSTI should help improve test scores (Harvey, 2007).

State Superintendent Joe Morton believes in the AMSTI program, stating, "Students enjoy AMSTI because it allows them to actually do math and science not just talk about it.... Teachers like the program because it supplies them with...math and science equipment and activities that directly address state standards" (Mosely, 2005, ¶ 6). John Dewey said it well when he said regarding a child's lesson in school, "There is all the difference in the world between having something to say and having to say something" (Dewey, 1990, p. 56).

On March 1, 2007, the Enterprise City School system experienced a horrific disaster when it was struck by a major tornado. While in the midst of cleaning up, the superintendent took the time to request AMSTI training for three of his schools for the 2007-2008 school year. He is confident the AMSTI method of teaching will help increase his school's test scores (Leonard, 2008).

Does inquiry-based learning as espoused by the AMSTI initiative work? The test scores of the students in the Decatur School District of Illinois have seen an improvement on the Illinois Standards Achievement Test since incorporating inquiry-based learning in their math classes. The Decatur School District improved more than any of the other 11 surrounding school districts. It was one of five districts to improve on the eleventh grade assessment, Prairie State Achievement Exam, when the majority of the eleventh graders' scores declined across the state. Only six of the 21 schools in the district did not make adequate yearly progress. For a school to be rated successful in 2007, 55% of the students had to meet the goals in math, up from a goal of 47.6% for 2006. Their middle school students did very well in math with 61.3% of seventh graders reaching the goal in math, and 65.8% of eighth graders meeting the math goal. Bill Smith, a teacher in the Decatur

School System teaches using manipulatives. He believes if a child can solve a problem visually then he can understand it in an abstract form as well (Wells, 2007).

Finally, it was Piaget who said, "The ideal of education is not to teach the maximum, to maximize the results, but above all to learn to learn, to learn to develop, and to learn to continue to develop after leaving school" (Piaget, 1973, p.30). That could be the kind of educated work force that would make businesses come to Alabama in great numbers.

CHAPTER III

METHODOLOGY

Overview

This research was centered on the AMSTI method of teaching mathematics and the effect it may have on students' math scores on the SAT 10. This research compared the eighth grade SAT 10 math scores of students who have been taught by AMSTI-trained math teachers to the previous two year's SAT 10 math scores of eighth graders who were not taught by AMSTI-trained math teachers. The scores were taken from the SAT 10 results for the eighth grade as a whole, pre-inception of AMSTI and post-inception of AMSTI, and on a school-by-school basis. As a result a *t* test was conducted to assess if the AMSTI method of teaching math resulted in an increase of SAT 10 math scores for eighth graders when compared to students who were not instructed utilizing the AMSTI method the previous two years. The SAT 10 is a multiple choice assessment given each spring to eighth grade students throughout the state of Alabama. The AMSTI initiative was begun seven years ago. Schools were added to the initiative on a school-by-school basis as 80% of the school administration and teachers of mathematics and science were willing to commit to the program. The teachers and administration of the school had to be willing to commit to two weeks of training during the summer for two consecutive years. Each year new training sites are added so more schools can enroll.

In addition, permission was granted by the International Review Board to conduct this research (see appendix B). This was a quantitative study as test scores were compared. The SAT 10 math scores of eighth graders from 20-25 schools were compared pre-and post-inception of AMSTI. The nature of this research dictates it must be an ex post facto

as the researcher initiated data collection after the intervention, AMSTI in this case, had commenced (Shavelson, 1996). The first variable assessed was the SAT 10 test scores two years prior to the inception of AMSTI, and then the dependent variable was measured; the resulting SAT 10 scores after the inception of the AMSTI intervention. The SAT 10 scores two years prior to the inception of AMSTI were assessed to confirm stability of the scores.

In addition, teachers' perceptions regarding AMSTI's effect on their students' test scores were targeted. Did the teachers feel AMSTI had resulted in increased test scores for the students when compared to the previous class of students who were not taught math by AMSTI-trained teachers? This information was collected at the AMSTI Summer Institute at two separate locations in the summer of 2008 with the use of a survey instrument (see Appendix A). These two locations were the University of South Alabama and the University of Montevallo. These locations were chosen for two reasons. First, they both were sites that have been in operation and were considered well established by the AMSTI math specialist, Catherine Jones. Second, the required numbers of surveys of 150-200 in order to get a representative sample were obtainable (C. Jones, personal communication, February 6, 2008). The survey was based primarily on an ordinal scale in order to reflect the strength of the teachers' opinions. It was meaningful to discover what variables were the most important based on the teachers' perceptions. There were three questions on the survey targeted to the teachers' perceptions of AMSTI and whether it has had a positive influence on their test scores and their performance as a teacher.

According to the SAT 10 web site, the SAT 10 is an objective assessment that informs teachers what students know. The SAT 10 should guide teachers towards high

achievement standards, according to the web site. The SAT 10 is available for kindergarten through 12th grade. It provides scaled scores, national and local percentile ranks, and stanines (Stanford Achievement Test Series, n.d.). Also stated on the web site, these test scores are valuable to administrators in helping them meet challenges from the *No Child Left Behind Act.*

Research Hypothesis

Eighth grade math students who have been taught utilizing techniques of the AMSTI method will show higher scores on the math portion of the SAT 10 than the previous year's eighth graders at the same school who were not taught mathematics utilizing the AMSTI method.

Participants

Permission was granted for the researcher to visit two locations to survey teachers who were in the second summer of the AMSTI Summer Institute Training session. At a minimum, this meant the teachers surveyed had at least one year of teaching utilizing the methods and materials supplied by the AMSTI Initiative. The teachers were from a variety of schools and school systems in two different areas of the state of Alabama. This provided a representative sample of teachers who were AMSTI-trained.

Also included were the eighth grade scores on a school-wide basis in southern and mid-Alabama whose SAT 10 math scores were used to assess the effect of AMSTI upon the scores when compared to the previous class of eighth graders who were not taught utilizing AMSTI methods.

Instrumentation

A survey was constructed, "Teachers Perceptions Regarding AMSTI Survey" (see Appendix A), to assess several factors regarding AMSTI, primarily the teacher's perceptions regarding AMSTI. The survey was piloted to several teachers who met the required qualifications prior to the actual collecting of data in June of 2008. Those qualifications were that they had at least one year of AMSTI training and were mathematics teachers. There was no apparent problem of the survey detected during the piloting phase.

Several teachers' perceptions were targeted on the survey: if the teachers felt the Local Pacing Guide infringed on their attempts to provide AMSTI lessons to their students, if the teachers believed the AMSTI lessons had improved their test scores, and, if the teachers believed they had become better mathematics teachers as a result of AMSTI. Also of interest to the researcher was whether school districts were allowing the teachers to participate in workshops, etc., as suggested by the AMSTI initiative. For example, the AMSTI math specialists wanted mathematics teachers to participate in at least two proffered AMSTI mathematics workshops per school year; AMSTI trainers asked that teachers be given designated times to collaborate with each other. Had that been done? Finally, AMSTI provided technology to the teachers, such as graphing calculators. Were the teachers utilizing this resource?

A second instrument, the SAT 10, was used to obtain eighth graders' test scores. The Sat 10 was item tested on over 170,000 students. In addition, 10,000 teachers participated by completing questionnaires with regard to curriculum match of questions. Norms were completed during the spring and fall with 250,000 students participating during the spring

and 110,000 students participating during the fall. Reliability was established in the high .80 range and total reading and math were close to .90. Validity was judged to be good due to "their well-defined test blueprint and careful development process" (Plake, Impara & Spiers, 2008).

Eighth Graders SAT 10 mathematics test scores were obtained for pre-inception of AMSTI, and then test scores for post-inception of ASMTI. These test scores were from the eighth grade students as a group, not individually. The SAT 10 is a norm-referenced assessment that students take throughout the United States.

Sampling Procedures

The schools from which these scores were taken had at least 80% of their teachers who have had at least one year of training by AMSTI trainers. The names of the schools were provided with the aid of Renee Wilkins, an AMSTI math specialist at the University of South Alabama site, who also consulted with the math specialist at the University of Montevallo AMSTI site (R. Wilkins, personal communication, March 19, 2008). Catherine Jones stated these two sites had worked hard to keep their participating schools at the 80% trained qualifier (C. Jones, personal communication, February 20, 2008).

Since the test scores were collected from all eighth grade students as a group and not individually, permission from the parents was not required. Students' scores were collected as a block; therefore, anonymity was guaranteed. Three consecutive years of SAT 10 math scores were collected. The first two years of scores collected were from the eighth grade population not taught utilizing AMSTI methods. The third group of scores collected was from the next school year and the eighth grade population who was taught

utilizing the AMSTI method. The researcher did not have access to any student names or teacher names.

The surveys were administered to AMSTI Summer Institute math teachers who had received one year of AMSTI training and were on site for the second year of training. The AMSTI Summer Institute had teachers of kindergarten through 12th grade in attendance. Catherine Jones, the math specialist for AMSTI, stated AMSTI agreed to allow the distribution of the survey during the institute. She also helped the researcher by informing her regarding the total number of expected teachers who fit the requirements in order to participate in the survey (C. Jones, personal communication, February 6, 2008).

Data Analysis

The hypothesis that the eighth grade students who had have been taught eighth grade math utilizing techniques of the AMSTI method would show higher math scores was evaluated by a *t* test. The *t* test is useful in comparing two groups, one which has had a treatment and one that has not (Keith, 2006). AMSTI is the treatment. The two groups were the eighth grade math students who were not taught math utilizing AMSTI methods and the next year's class of eighth graders who were taught math utilizing the ASMTI methods.

In addition, the survey tool, "Teachers Perceptions Regarding AMSTI Survey," was used to describe how well teachers perceived AMSTI methods to be working in increasing SAT 10 math scores for the students at their school. The researcher was also interested in whether teachers believed they were better math teachers after having been trained in the AMSTI method.

CHAPTER IV

ANALYSIS OF DATA

This research was comprised of two components. The first component was the comparison of SAT 10 test scores of eighth grade classes before the teachers were trained utilizing the AMSTI method and the SAT 10 scores of the eighth graders after the teachers had participated in one Summer Institute of AMSTI training and taught one year utilizing the techniques taught in the AMSTI Summer Institute.

Design and Procedure SAT 10

The SAT 10 mathematics scores from each of the selected schools of the two consecutive years of SAT 10 scores prior to the inception of AMSTI were collected and then averaged. SAT 10 test scores were available on the Alabama Department of Education web site. The SAT 10 mathematics scores for the first year post AMSTI Summer Institute were collected as well. These scores were from eighth graders who had been taught for one school year utilizing AMSTI techniques. Only scores of 21 schools which had at least 80% of their math and science teachers trained in AMSTI were used. Of these schools six became AMSTI schools in the 2007-2008 school year, 12 became ASMTI schools in the 2006-2007 school year, two became AMSTI schools in the 2005-2006 school year, and one became an AMSTI school in the 2004-2005 school year. The names of qualifying AMSTI schools were supplied by three individuals: Rene Wilkins, an AMSTI mathematics specialist at the University of South Alabama site; Deb O'Hara, a secondary mathematics specialist from the University of Montevallo site; and Nadine Scarborough, Troy University site director. Nadine Scarborough was an additional resource who was consulted to complete the 20+ AMSTI schools that were needed to

perform the research. The two years of SAT 10 mathematics scores prior to inception of AMSTI were averaged and then a *t* test was conducted with the pre-inception and post-inception of AMSTI scores.

Results

The results of the hypothesis: Eighth grade math students who have been taught utilizing techniques of the AMSTI method will show higher scores on the math portion of the SAT 10 than the previous year's eighth graders at the same school who were not taught mathematics utilizing the AMSTI method, follows.

A paired-samples *t* test was calculated to compare the mean pre-AMSTI eighth grade SAT 10 mathematics scores of 21 schools to the post-AMSTI eighth grade SAT 10 mathematics scores. The mean SAT 10 mathematics score for eighth graders pre-AMSTI was 48.17 (sd = 12.08) and the mean on the post-AMSTI SAT 10 mathematics score was 47.83 (sd = 13.21). No statistically significant difference from pre-inception of AMSTI to post-inception of AMSTI was found in the SAT 10 scores of eighth graders ($t(20) = .319$, p=.376).

The minima and maxima scores for the pre-inception of AMSTI were 32 and 74. The minima and maxima for the post-inception of AMSTI were 30 and 79.

Design and Procedure - Teachers' Perceptions Regarding AMSTI

The second component of this research was a survey of teachers' perceptions regarding AMSTI. The researcher surveyed math teachers, grades kindergarten through 12th grade, who were attending AMSTI training for the second year. These teachers had already taught mathematics one year with knowledge of the AMSTI method of teaching mathematics and would have had in their possession for one school year the AMSTI kit

which is provided to math teachers who have completed the first year of AMSTI training. The researcher obtained surveys from two AMSTI training sites. The first is located in an area serviced by the University of South Alabama AMSTI site located near Mobile, Alabama. The second site is serviced by the University of Montevallo AMSTI site located in Shelby County, Alabama, in the Birmingham metro area.

Participants

The researcher was able to obtain surveys from teachers who teach mathematics from kindergarten through twelfth grade in 24 Alabama school systems. There were a total of 286 surveys collected, one of which was eliminated because it had been completed by a university instructor, information which the instructor had indicated on the survey. No other surveys were deleted as the researcher deemed surveys that might have some missing responses were still helpful. The remaining surveys were entered into SPSS and percentages were completed on the survey's queries. It should be noted that responses of surveys from grades 9 - 12 were tallied as grade nine and are discussed in the text as "high school." Once in high school, students of various grades may be in the same mathematics class, so it was not feasible to separate a teacher of geometry, for example, who may have tenth through twelfth graders in the same class.

The responders were asked how many years of teaching experience they had. The results of the query yielded the following percentages: one to three years of experience - 30.5%, four to six years experience - 20.9%, seven through nine years - 12.1%, and more than 10 years - 36.5%.

Combining the participants from both locations, the total number of teachers from each grade were as follows: Nineteen kindergarten teachers, 43 first grade teachers, 35

second grade teachers, 41 third grade teachers, 47 fourth grade teachers, 37 fifth grade teachers, 18 sixth grade teachers, eight seventh grade teachers, 13 eighth grade teachers, and 24 high school teachers, grades 9-12. The University of Montevallo AMSTI site yielded 160 surveys, and the remaining 125 were collected from the University of South Alabama AMSTI site location.

Results

Table 1

"Local Pacing Guide Requirements Hinder My Ability to Plan and Execute AMSTI Lessons."

School System	1	2	3	4	5
Bibb Co. (n 17)	17.6%	11.8%	5.9%	35.3%	29.4%
Shelby Co. (n 69)	23.2%	26.1%	27.5%	11.6%	11.6%
Homewood City (n 18)	33.3%	22.2%	22.2%	16.7%	5.6%
Vestavia City (n 11)	54.5%	36.4%	9.1%	0%	0%
Talladega City (n 9)	12.5%	37.5%	12.5%	12.5%	25%
Talladega Co. (n 5)	20%	20%	0%	40%	20%
Mobile Co. (n 75)	15.1%	20.5%	39.7%	16.4%	8.2%
Baldwin Co. (n 35)	11.4%	25.7%	34.3%	25.7%	2.9%
Clarke Co. (n 10)	22.2%	33.3%	33.3%	11.1%	0%

Note: Responses are as follows, 1 – strongly disagree, 2 – disagree, 3 - neither agree nor disagree, 4 – agree, 5 – strongly agree.

First Query

The results of the query, "Local Pacing Guide requirements hinder my ability to plan and execute AMSTI lessons" were tallied by county. Those counties which had fewer than five participants were not included. Bibb County Public School System had the greatest percentage of teachers who agreed or strongly agreed to the query with 64.7%, and Talladega County participants responded with 60% agreeing or strongly agreeing to the statement. The teachers of the following counties disagreed or strongly disagreed with the greatest percentages: Vestavia City – 90.9%, Homewood City – 55.5%, Clarke County – 50.5%, and Shelby County – 49.3%.

Second Query

Percentages were taken from teachers of grades three through eight whose students took the SAT 10 assessment in response to the query "AMSTI lessons have increased my students' scores on the SAT."

Table 2

"AMSTI Lessons Have Increased My Students' Scores On the SAT."

Grade	1	2	3	4	5
Third Grade (n 40)	0%	13.9%	50%	16.7%	5.6%
Fourth Grade (n 47)	2.6%	17.9%	33.3%	23.1%	12.8%
Fifth Grade (n 37)	0%	14.8%	63%	14.8%	0%
Sixth Grade (n 18)	0%	5.9%	70.6%	17.6%	5.9%
Seventh Grade (n 8)	0%	0%	87.5%	0%	12.5%
Eighth Grade (n 13)	0%	9.1%	45.5%	45.5%	0%

Note: Responses are as follows, 1 – strongly disagree, 2 – disagree, 3 - neither agree nor disagree, 4 – agree, 5 – strongly agree.

Only grades three through eight are included as not all grades participate in the SAT 10 mathematics assessment in the state of Alabama. Of those grades, the resulting percentages of those who either agreed or strongly agreed to the query with the highest percentages were as follows: fourth grade – 35.9%, sixth grade – 23.5%, and eighth grade - 50%. The resulting percentages of the teachers who either disagreed or strongly disagreed with the highest percentages were as follows: third grade - 13.9%, fourth grade – 20.5%, and fifth grade – 14.8%.

Third Query

Table 3

"Generally I Believe AMSTI Has Helped to Increase Test Scores for My Students"

Grade	1	2	3	4	5
Kindergarten (n 19)	0%	0%	12.5%	62.5%	25%
First Grade (n 43)	0%	2.4%	29.3%	36.6%	29.3%
Second Grade (n 35)	0%	9.4%	34.4%	31.3%	25%
Third Grade (n 40)	0%	13.2%	50%	28.9%	7.9%
Fourth Grade (n 47)	7.3%	17.1%	26.8%	29.3%	19.5%
Fifth Grade (n 37)	0%	3.1%	75%	18.8%	3.1%
Sixth Grade (n 18)	0%	5.9%	64.7%	17.6%	11.8%
Seventh Grade (n 8)	0%	0%	75%	12.5%	12.5%
Eighth Grade (n 13)	0%	8.3%	41.7%	50%	0%
High School (n 24)	0%	13%	60.9%	13%	13%

Note: Responses are as follows, 1 – strongly disagree, 2 – disagree, 3 - neither agree nor disagree, 4 – agree, 5 – strongly agree.

All grades were included in the query, "Generally I believe AMSTI has helped to increase test scores for my students." The resulting percentages of teachers who either agreed or strongly agreed with the highest percentages, by grade, are as follows: kindergarten – 87.5%, first grade – 65.9%, second grade – 56.3%, and eighth grade - 50%. The group of teachers who either strongly disagreed or disagreed with the greatest percentage was the fourth grade teachers at 24.4%.

Fourth Query

Percentages were established with regard to years of experience and the query, "I believe AMSTI has made me a better math teacher." The result of the query found that teachers who had one to three years of teaching experience either agreed or strongly

Table 4

"I Believe AMSTI Has Made Me a Better Math Teacher."

Years of Teaching Experience	1	2	3	4	5
1 – 3 years (n 86)	0%	7%	27.9%	45.3%	19.8%
4 – 6 years (n 59)	3.4%	3.4%	22%	42.4%	28.8%
7 – 9 years (n 34)	0%	0%	14.7%	64.7%	20.6%
10+ years (n 103)	1%	7.8%	27.2%	33%	31.1%

Note: Responses are as follows, 1 – strongly disagree, 2 – disagree, 3 - neither agree nor disagree, 4 – agree, 5 – strongly agree

agreed with that statement, 65.1%. Teachers who had four to six years or teaching either agreed or strongly agreed with 71.2%, and teachers with seven to nine years of teaching experience had the highest percentage, 85.3%. Finally, teachers with more than 10 years of experience either agreed or strongly agreed with 64.1%. The highest percentages of

teachers who either disagreed or strongly disagreed were the teachers with 10 or more years of experience at 8.8%.

When evaluated by grade the percentages of those who agreed or strongly agreed were all at or above 54.2% (teachers of grades 9-12). The highest percentage was 84.6% of eighth grade teachers who agreed or strongly agreed that AMSTI helped them to be better mathematics teachers. The overall percentage for all teachers who agreed or strongly agreed AMSTI has made them a better math teacher was 68.7%. Fourth grade teachers either disagreed or strongly disagreed with the greatest percentage, 17%, followed by third grade teachers at 12.5%. The overall percentage of those who disagreed or strongly disagreed was 6.7%.

Fifth Query

How often AMSTI lessons were enacted was tabulated by grade and county. The choices given for a response were daily, two or more a week, at least 2-4 a month, once a month, 2-3 a quarter, and zero. Again, school systems with less than five participants were not addressed. With regard to the teachers' responses by county, the greatest percentage was 82.4% from the Bibb County Public School teachers who responded they teach mathematics utilizing methods taught by AMSTI two or more a week. Other public school systems which responded to the same query with the greatest percentages for enacting lessons more than twice a week: Talladega City Public Schools - 77.8%, Shelby County Schools- 73.6%, Chilton County Schools – 62.5%, and Mobile Public Schools – 46.6%. The school systems with the greatest percentage of teachers who responded they never teach utilizing the AMSTI method or teach utilizing this method 2 – 3 a quarter, were Clarke County teachers – 60%, Chilton County teachers – 37.5%, Vestavia City

teachers – 36.4%, Baldwin County teachers – 26.5%, Talladega County teachers – 20%, and Mobile County teachers – 17.8%. The school system with the greatest percentage of teachers who responded they never teach mathematics utilizing AMSTI was Homewood City Public Schools at 5.6%.

Table 5

"I Enact AMSTI Lessons-" by School System

School System	1	2	3	4	5	6
Bibb Co. (n 17)	35.3%	47.1%	0%	0%	17.6%	0%
Shelby Co. (n 69)	41.2%	32.4%	16.2%	5.9%	4.4%	0%
Homewood City (n 4)	0%	38.9%	27.8%	16.7%	11.1%	5.6%
Chilton Co. (n 8)	37.5%	25%	0%	0%	37.5%	0%
Vestavia City (n 13)	18.2%	27.3%	18.2%	0%	36.4%	0%
Talladega City (n 9)	22.2%	55.6%	11.1%	11.1%	0%	0%
Talladega Co. (n 17)	20%	20%	20%	20%	20%	0%
Mobile Co. (n 20)	11%	35.6%	21.9%	13.7%	16.4%	1.4%
Baldwin Co. (n 21)	14.7%	23.5%	29.4%	5.9%	26.5%	0%
Clarke Co. (n 10)	0%	20%	0%	20%	60%	0%

Note: Responses are as follows:1- daily, 2-two or more a week, 3-at least 2-4 a month, 4-once a month, 5- 2-3 a quarter, and 6-zero

The results of the same query regarding how many times the teacher utilizes AMSTI techniques to teach math by grade showed that 100% of kindergarten teachers reported they taught an AMSTI math lesson daily or two or more times a week. The second greatest percentage, 88.6%, was the second grade teachers, followed closely by a percentage of 85.4% for the first grade teachers. The lowest percentages by grade who

responded they taught an AMSTI lesson daily or two or more a week were the sixth grade, 22%; the high school teachers, 16.6%; eighth grade 15.4%; and the seventh grade, 12.5%. The greatest percentage who reported they enacted an AMSTI lesson either 2-3 per quarter or none per quarter were the seventh grade teachers, 75%; followed by the high school teachers, 58.4%; and the eighth grade teachers, 38.5%.

Table 6

"I Enact AMSTI Lessons-" by Grade

Grade	1	2	3	4	5	6
Kindergarten (n 19)	36.8%	63.2%	0%	0%	0%	0%
First Grade (n 43)	41.5%	43.9%	9.8%	4.9%	0%	0%
Second Grade (n 35)	54.3%	34.3%	11.4%	0%	0%	0%
Third Grade (n 40)	12.5%	32.5%	17.5%	20%	17.5%	0%
Fourth Grade (n 47)	17.4%	45.7%	13%	4.3%	17.4%	2.2%
Fifth Grade (n 37)	16.7%	25%	38.9%	5.6%	13.9%	0%
Sixth Grade (n 18)	0%	22.2%	38.9%	27.8%	11.1%	0%
Seventh Grade (n 8)	0%	12.5%	12.5%	0%	75%	0%
Eighth Grade (n 13)	0%	15.4%	15.4%	30.8%	38.5%	0%
High School (n 24)	8.3%	8.3%	16.7%	8.3%	54.2%	4.2%

Note: Responses are as follows:1- daily, 2-two or more a week, 3-at least 2-4 a month, 4-once a month, 5- 2-3 a quarter, and 6-zero

Sixth Query

Percentages of the query "Other demands (paper work, etc.) have impacted my ability in a negative way to enact AMSTI lessons," were tabulated by both grade and school system. The results of the teachers by grade who either agreed or strongly agreed with the

greatest percentages to that statement were as follows kindergarten - 52.7%, first grade – 37.2%, third grade - 53.9%, fourth grade – 37%, fifth grade - 59.4%, and sixth grade – 38.9%. All grades combined reported a response of 40.7%, who either agreed or strongly agreed to the query. The results of the same query with responses of disagree or strongly disagree with the greatest percentages were; kindergarten–36.8%, first grade–39.5%, second grade–48.6%, and seventh grade–42.9%.

Table 7

"Other Demands (Paper Work, etc.) Placed Upon Me by My School or Central Office Administration Has Impacted My Ability In a Negative Way to Enact AMSTI Lessons" by Grade

Grade	1	2	3	4	5
Kindergarten (N 19)	10.5%	26.3%	10.5%	31.6%	21.1%
First Grade (n 43)	9.3%	30.2%	23.3%	27.9%	9.3%
Second Grade (n 35)	22.9%	25.7%	22.9%	11.4%	17.1%
Third Grade (n 40)	2.6%	25.6%	17.9%	30.8%	23.1%
Fourth Grade (n 47)	10.9%	17.4%	34.8%	19.6%	17.4%
Fifth Grade (n 37)	0%	8.1%	32.4%	35.1%	24.3%
Sixth Grade (n 18)	5.6%	16.7%	38.9%	33.3%	5.6%
Seventh Grade (n 8)	0%	42.9%	28.6%	28.6%	0%
Eighth Grade (n 13)	7.7%	15.4%	46.2%	7.7%	23.1%
High School (n 24)	17.4%	8.7%	52.2%	4.3%	17.4%

Note: Responses are as follows, 1 – strongly disagree, 2 – disagree, 3 - neither agree nor disagree, 4 – agree, 5 – strongly agree.

By school system the results of the query with the greatest percentages either agreeing or strongly agreeing, and in which there were at least five responders, were; Homewood City Public School System–61.1%, Talladega City Public School System–55.6%, Mobile County Public School System–55.4%, and Vestavia City Public School System–45.5%.

Table 8

"Other Demands (Paper Work, ETC.) Placed Upon Me by My School or Central Office Administration Has Impacted My Ability In a Negative Way to Enact AMSTI Lessons" By School System

School System	1	2	3	4	5
Bibb Co. (n 17)	11.8%	29.4%	29.4%	23.5%	5.9%
Shelby Co. (n 69)	11.6%	33.3%	24.6%	18.8%	11.6%
Homewood City (n 18)	5.6%	5.6%	27.8%	50%	11.1%
Clinton Co. (n 8)	12.5%	25%	25%	37.5%	0%
Vestavia City (n 11)	9.1%	27.3%	18.2%	36.4%	9.1%
Talladega City (n 9)	11.1%	22.2%	11.1%	0%	55.6%
Talladega Co. (n 5)	0%	20%	60%	0%	20%
Mobile Co. (n 75)	4.1%	13.5%	27%	29.7%	25.7%
Baldwin Co. (n 365)	18.2%	12.1%	30.3%	15.2%	24.2%
Clarke Co. (n 10)	0%	0%	90%	0%	10%

Note: Responses are as follows, 1 – strongly disagree, 2 – disagree, 3 - neither agree nor disagree, 4 – agree, 5 – strongly agree.

By school system the results of the query either disagreeing or strongly disagreeing with the greatest percentages were; Shelby County Public School System–44.9%, Bibb

County Public School System–41.2%, Chilton County Public School System–37.5%, and Vestavia City School System–36.4%.

Seventh Query

Table 9

"How Many Content Specific (Mathematics) Workshops Did You Attend This Year?" by Grade

Grade	*Frequency*		
	None	1 – 2	3 or more
Kindergarten (n 19)	57.9%	21.1%	15.8%
First Grade (n 43)	18.6%	62.8%	18.6%
Second Grade (n 35)	14.3%	54.3%	31.4%
Third Grade (n 40)	27.5%	55%	17.4%
Fourth Grade (n 47)	13%	65.2%	21.7%
Fifth Grade (n 37)	19.4%	66.7%	13.9%
Sixth Grade (n 18)	33.3%	38.9%	27.8%
Seventh Grade (n 8)	37.5%	50%	12.5%
Eighth Grade (n 13)	30.8%	30.8%	38.5%
High School (n 24)	20.8%	45.8%	33.3%

Note: Some responses do not total 100% due to some no responses.

When asked, "How many content specific (mathematics) workshops did you attend this year?" the teachers of the following grades responded with the greatest percentages: 18.6% of first grade teachers attended three or more and a combined total of 81.4% attended one or more, 31.4% of second grade teachers attended three or more and a

combined total of 85.7% attended one or more, 21.7% of fourth grade teachers attended three or more and a combined total of 86.9% attended one or more, 13.9% of fifth grade teachers attended three or more and a combined total of 80.6% attended one or more. The totals for all grades were .4% no response, 23.4% attended no mathematics workshops the previous school year, 53.9% attended one-two mathematics workshops, and 22.3% attended three or more mathematics workshops the previous school year. The teachers of the following grades reported the highest percentages for not attending a mathematics workshop the previous school year; kindergarten- 57.9%, seventh grade- 37.5%, and sixth grade 33.3%.

This same query was also tabulated by school system with the following results: 100% of Bibb County Public School Systems teachers reported they had attended at least one mathematics workshop the previous school year with 41.2% of those responders having attended three or more. Baldwin County Public School teachers responded with 91.4% had attended at least one mathematics workshop the previous school year and 20% of those teachers reported they had attended three or more. Vestavia City Public School teachers responded with 88.9% who reported they had attended at least one mathematics workshop the previous school year and 22.2% of those teachers said they had attended three or more workshops. In addition, 88.9% of Homewood City Public School teachers reported they had attended at least one mathematics workshop the previous year and 22.2% of those teachers attended three or more mathematics workshops. Other school systems with a percentage of 50% or higher whose teachers responded they had attended one or more mathematics workshop and had more than five responders for the school system were: Clarke County - 80%, Talladega County Public School System - 80%,

Shelby County Public Schools - 71%, Mobile County Public School System - 65.3%, and Talladega City School system 55.5%.

Table 10

"How Many Content Specific (Mathematics) Workshops Did You Attend This Year?" by School System

School System	*Frequency*		
	None	1 – 2	3 or more
Bibb Co. (n 17)	0%	58.8%	41.2%
Shelby Co. (n 69)	27.5%	58%	13%
Homewood City (n 18)	11.1%	66.7%	22.2%
Chilton Co. (n 8)	62.5%	37.5%	0%
Vestavia City (n 11)	11.1%	66.7%	22.2%
Talladega City (n 9)	44.4%	44.4%	11.1%
Talladega Co. (n 5)	20%	40%	40%
Mobile Co. (n 75)	34.7%	44%	21.3%
Baldwin Co. (n 35)	8.6%	71.4%	20%
Clarke Co. (n 10)	20%	50%	30%

Note: Some responses do not total 100% due to some no responses.

Eighth Query

When queried, "Scheduling allows me to collaborate with colleagues during planning periods," the responses of teachers who responded they agreed or strongly agreed with the greatest percentages were tabulated by grade with the following results: Kindergarten teachers responded they either agreed or strongly agreed to the query - 52.7%, second

grade - 62.9%, third grade - 55%, fifth grade - 53.5%, eighth grade - 53.9%. The teachers by grade who either disagreed or strongly disagreed with percentages of 30% or greater were as follows; fourth grade - 34.8%, fifth grade - 32.4%, sixth grade - 38.9%, seventh grade - 37.5%, eighth grade - 30.8%, and high school - 62.5%.

Table 11

"I Am Allowed to Collaborate With Colleagues During Planning Periods"

Grade	1	2	3	4	5
Kindergarten (n 19)	15.8%	21.1%	5.3%	31.6%	21.1%
First Grade (n 43)	9.3%	16.3%	32.6%	27.9%	14%
Second Grade (n 35)	17.1%	0%	20%	22.9%	40%
Third Grade (n 40)	7.5%	15%	22.5%	30%	25%
Fourth Grade (n 47)	23.9%	10.9%	19.6%	26.1%	19.6%
Fifth Grade (n 37)	13.5%	18.9%	13.5%	40.5%	13.5%
Sixth Grade (n 18)	22.2%	16.7%	16.7%	22.2%	22.2%
Seventh Grade (n 8)	0%	37.5%	37.5%	12.5%	12.5%
Eighth Grade (n 13)	23.1%	7.7%	15.4%	15.4%	38.5%
High School (n 24)	41.7%	20.8%	20.8%	12.5%	4.2%

Note: Responses are as follows, 1 – strongly disagree, 2 – disagree, 3 - neither agree nor disagree, 4 – agree, 5 – strongly agree. Kindergarten does not total to 100% due to some none responses.

Ninth Query

The last query on the survey was "AMSTI training has allowed me to incorporate technology into my mathematics lessons." The percentages by grade who agreed or strongly agreed to the statement were as follows: kindergarten - 31.6%, first grade -

37.3%, second grade - 48.5%, third grade - 37.5%, fourth grade - 44.7%, fifth grade - 21.6%, sixth grade - 50%, seventh grade - 75%, eighth grade - 84.6%, and high school – 60.9%. Percentages of 30% or greater by teachers who disagreed or strongly disagreed with the query were: fourth grade - 34.1% and fifth grade - 35.1%. Of the total responses 7.4% strongly disagreed, 13.1% disagreed, 36% neither agreed nor disagreed, 30% agreed, and 13.4% strongly agreed.

Table 12

"AMSTI Training Has Allowed Me to Incorporate Technology into My Mathematics Lessons"

Grade	1	2	3	4	5
Kindergarten (n 19)	5.3%	5.3%	57.9%	26.3%	5.3%
First Grade (n 43)	7%	4.7%	51.2%	32.6%	4.7%
Second Grade (n 35)	2.9%	11.4%	37.1%	31.4%	17.1%
Third Grade (n 40)	2.5%	20%	40%	25%	12.5%
Fourth Grade (n 47)	21.3%	12.8%	21.3%	31.9%	12.8%
Fifth Grade (n 37)	10.8%	24.3%	43.2%	13.5%	8.1%
Sixth Grade (n 18)	5.6%	16.7%	27.8%	33.3%	16.7%
Seventh Grade (n 18)	0%	0%	25%	37.5%	37.5%
Eighth Grade (n 13)	0%	0%	15.4%	61.5%	23.1%
High School (n 24)	0%	17.4%	21.7%	34.8%	26.1%

Note: Responses are as follows, 1 – strongly disagree, 2 – disagree, 3 - neither agree nor disagree, 4 – agree, 5 – strongly agree. Kindergarten does not total to 100% due to some none responses.

Pairing of Queries

The researcher was interested in perceptions the teachers of mathematics had and if one question might mirror the results in another question. For example, if the teachers of mathematics feel that AMSTI has made them a better math teacher, would that be reflected in the number of content specific workshops they were able to attend the 2007-2008 school year?

Query Four and Seven

The results from the statement, "I believe AMSTI has made me a better math teacher" were aligned with the question, "How many content specific workshops did you attend this past year?" The closest results were yielded from the seventh grade teachers. The results from both queries yielded a 62.5%. The second closest results were from the first grade teachers. The majority of teachers, 83.8%, responded AMSTI made them a better math teacher, and 81.4% said they had been to at least one mathematics workshop this past year. The greatest discrepancy was found among the kindergarten teachers as 84.2% responded they felt AMSTI was helping them to be a better mathematics teacher, but only 36.8% of the teachers had been to at least one mathematics workshop the past school year. This was a 47.4% difference. Eighth grade teachers' results found 84.6% believed AMSTI helped them to be better teachers of mathematics. This value reflected the highest percentage among all the grades. However, they were not the greatest recipients of mathematics workshops as 69.3% went to at least one workshop the previous school year. With the exception of the kindergarten teachers, the results were generally within 10-15 percentage points of the two queries.

Table 13

Comparison by Grade of Workshops Attended and "I Believe AMSTI Has Made Me a Better Mathematics Teacher"

Grade	Workshops	Better Teacher	Difference
Kindergarten (n 19)	36.8%	84.2%	47.4%
First Grade (n 43)	81.4%	83.8%	2.4%
Second Grade (n 35)	85.7%	71.4%	14.3%
Third Grade (n 40)	72.5%	57.5%	15%
Fourth Grade (n 47)	86.9%	61.7%	25.2%
Fifth Grade (n 37)	80.6%	62.2%	18.4%
Sixth Grade (n 18)	66.7%	77.8%	11.1%
Seventh Grade (n 8)	62.5%	62.5%	0%
Eighth Grade (n 13)	69.3%	84.6%	15.3%
High School (n 24)	79.1%	54.2%	24.9%

Note: Responses are either agree or strongly agree.

Query Seven and Three

The results of "How many content specific workshops did you attend this past year?" were aligned with "Generally I believe AMSTI has helped to increase test scores for my students." The closest alignment came from the first grade teachers. While 81.4% attended at least one mathematics workshop last year, 65.9% of these teachers responded with either agree or strongly agree that they believe AMSTI is helping to increase test

scores for their students. The second closest percentage was found in the eighth grade teacher's responses. While 69.3% had been to at least one mathematics workshop this past year, 50% agreed or strongly agreed AMSTI was helping to increase student test scores. The greatest difference was found in the fifth grade teachers results. It showed that 80.6% of teachers had been to at least one mathematics workshop the past year, and 21.9% agreed or strongly agreed ASMTI was helping to increase their student test scores. This was a difference of 58.7%.

Table 14

Comparison by Grade of Workshops Attended and Perception of "Generally I Believe AMSTI Has Helped to Increase Test Scores for My Students"

Grade	Workshops	Increased Test Scores	Difference
Kindergarten (n 19)	36.8%	87.5%	50.7%
First Grade (n 43)	81.4%	65.9%	15.5%
Second Grade (n 35)	85.7%	56.3%	29.4%
Third Grade (n 40)	72.5%	36.8%	35.7%
Fourth Grade (n 47)	86.9%	48.8%	38.1%
Fifth Grade (n 37)	80.6%	21.9%	58.7%
Sixth Grade (n 18)	66.7%	29.4%	37.3%
Seventh Grade (n 8)	62.5%	25%	37.5%
Eighth Grade (n 13)	69.3%	50%	19.3%
High School (n 24)	79.1%	26%	53.1%

Note: Responses indicate agree or strongly agree.

Query Six and Three

Table 15

Comparison of "Other Demands Have Impacted My Ability in a Negative Way" to "AMSTI Lessons Have Increased My Students' Scores on the SAT 10."

Grade	Non-instructional Demands	Increased Test Scores	Difference
Third Grade (n 40)	53.9%	22.3%	31.6%
Fourth Grade (n 47)	37%	35.9%	1.1%
Fifth Grade (n 37)	59.4%	14.8%	44.6%
Sixth Grade (n 18)	38.9%	23.5%	15.4%
Seventh Grade (n 8)	29.6%	12.5%	17.1%
Eighth Grade (n 13)	30.8%	45.5%	14.7%

Note: Responses indicate agree or strongly agree

The difference between "Other demands (paper work, etc.) have impacted my ability in a negative way to enact AMSTI lessons," was aligned with the query, "AMSTI lessons have increased my students' scores on the SAT 10."The results were limited to third through eighth grades as the remaining grades did not participate in the SAT 10 assessment in Alabama. Resulting totals reflect responses of either agree or strongly agree. The fifth grade teachers responded with the highest percentage that other demands were impacting their ability to enact AMSTI lessons, and they also responded with one of the lowest percentages that AMSTI was helping to increase their SAT 10 scores, for a difference of 44.6%. The third grade teachers had the second highest difference at 31.6%,

as 53.9% responded that other demands have impacted their ability in a negative way to enact AMSTI lessons, yet, 22.3% believe AMSTI has helped to increase their SAT 10 scores. The least difference at 1.1% was located from the fourth grade teachers, as 37% responded that other demands were impacting in a negative way their ability to enact AMSTI lessons, but 35.9% thought AMSTI was helping to increase their Sat 10 scores.

Query Four and One

Table 16

Comparison by School System of "I Believe AMSTI Has Made Me a Better Mathematics Teacher" With "Local Pacing Guide Requirements Hinder My Ability to Plan and Execute AMSTI Lessons."

School System	Better Mathematics Teacher	Pacing Guide Inhibits	Difference
Bibb County (n 17)	64.7%	64.7%	0%
Shelby County (n 69)	62.3%	23.2%	39.1%
Homewood City (n 18)	44.5%	22.3%	22.2%
Talladega City (n 9)	77.7%	37.5%	40.2%
Talladega County (n 5)	60%	60%	0%
Mobile County (n 75)	77.4%	24.6%	52.8%
Baldwin County (n 35)	74.3%	28.6%	45.7%
Clarke County (n 10)	40%	11.1%	28.9%

Note. The scores indicate either agree or strongly agree responses. Only responses from school systems numbering five or more responders and whose school system utilizes a local pacing guide were utilized.

School systems were then compared with the queries "I believe AMSTI has made me

a better math teacher" and "Local pacing guide requirements hinder my ability to plan and execute AMSTI lessons." Bibb County Public School teachers responded with the same percentage to both queries, 64.7%, as did Talladega County teachers with 60%. The third smallest percentage difference was from the teachers of the Homewood City Public School System at 22.2%. The greatest differences were found in the responses from the Mobile County Public School teachers, 52.8%, and the Baldwin County Public School system teachers, 45.7%.

Query Five and Three

"I enact AMSTI lessons…" was aligned with "AMSTI lessons have increased my students' scores on the SAT." Again, because only grades third through eighth take the SAT 10 assessment, these were the grades which were considered. The response percentages for "I enact AMSTI lessons" were for those responses that reflected an answer of daily or two or more per week. The percentages for "AMSTI lessons have increased my students' scores on the SAT 10," are for those responses that reflected an answer of agree or strongly agree. The greatest percentage of teachers who believed AMSTI has helped to increase students SAT 10 scores are the eighth grade teachers, yet those teachers were the second from the bottom in the frequency in which they enacted AMSTI lessons. The difference for the eighth grade teachers' responses between the two queries was 30.16%. The fourth grade teachers' responses indicate the greatest percentage for AMSTI lessons enacted and also the second highest percentages who believed AMSTI helped to increase the students SAT 10 scores. The seventh grade teachers had a response of 12.5% who enacted AMSTI lessons at least twice a week, the lowest percentage reported in the third through eighth grade teachers, and they had the

lowest percentage of teachers, 12.5%, who believed AMSTI helped to increase their students SAT 10 test scores. There was no difference between the two scores. Regarding sixth grade teachers, 22% responded they enacted AMSTI lessons two or more times a week, and 23.5% believed AMSTI was helping to increase students SAT 10 mathematics scores.

Table 17

Comparison by Grade of "I Enact AMSTI Lessons" to "AMSTI Lessons Have Increased My Students' Scores On the SAT 10."

Grade	Enact Lessons	Increased Test Scores	Difference
Third Grade (n 40)	45%	22.3%	22.7%
Fourth Grade (n 47)	63.1%	35.9%	27.2%
Fifth Grade (n 37)	41.7%	14.8%	26.9%
Sixth Grade (n 18)	22%	23.5%	1.5%
Seventh Grade (n 8)	12.5%	12.5%	0%
Eighth Grade (n 13)	15.4%	45.5%	30.1%

Note. The percentages for "Enact Lessons" reflect responses of either "daily" or "two or more a week." The "Test Scores Increased" percentages reflect either agree or strongly agree responses.

Query Four and Nine

If teachers were able to use more technology in their mathematics classroom, does that help the teachers' perception that they were a better mathematics teacher? In consideration of this "I believe AMSTI has made me a better mathematics teacher" was aligned with "AMSTI training has allowed me to incorporate technology into my

mathematics lessons." Again the reported percentages indicated either agree or strongly agree to the queries.

Table 18

Comparison by Grade of "AMSTI Training Has Allowed Me to Incorporate Technology Into My Mathematics Lessons" and "I Believe AMSTI Has Made Me a Better Mathematics Teacher"

Grade	Technology	Better Teachers	Difference
Kindergarten (n 19)	31.6%	84.2%	52.6%
First Grade (n 43)	37.3%	83.8%	46.5%
Second Grade (n 35)	48.8%	71.4%	22.6%
Third Grade (n 40)	37.5%	57.5%	20%
Fourth Grade (n 47)	44.7%	61.7%	17%
Fifth Grade (n 37)	21.6%	62.2%	40.9%
Sixth Grade (n 18)	50%	77.8%	27.8%
Seventh Grade (n 8)	75%	62.5%	12.5%
Eighth Grade (n 13)	84.6%	84.6%	0%
High School (n 24)	60.9%	54.2%	6.7%

Note. The scores indicate either agree or strongly agree responses.

The eighth grade teachers had no difference between the two queries with a response of 84.6% for both responses. The high school teachers reported 60.9% for "AMSTI training has allowed me to incorporate technology into my mathematics lessons" and

54.2% responded either agree or strongly agree to "I believe AMSTI has made me a better mathematics teacher." The difference between the two percentages was 6.7%. The greatest difference was 46.5% from first grade teachers. First grade teachers responded with either agree or strongly agree, 37.3%, to "AMSTI training has allowed me to incorporate technology into my mathematics lessons" and 83.8% either agreed or strongly agreed to the statement "I believe AMSTI has made me a better mathematics teacher."

Ancillary Findings

One concern discovered by use of the survey was the manner in which the percentage of teachers dropped as the years progressed. One to three years of experience comprised 30.5% of the responders; three through six years of experience comprised 20.9% of the responders, a difference of 9.6 percentage points; seven to nine years of teaching experience comprised 12.1 percentage points, and an 18.4 difference in percentage points when compared to the first through third year teachers. Teachers with 10 or more years comprised 36.5%; however, that percentage reflected teachers experience from 10 years through retirement. The drop in teachers from the first years through the ninth year should be of concern. What is it that is driving these teachers out of the profession?

Other concerns discovered, but not surveyed, from the survey were the apparent anger exhibited by some teachers. Some teachers took the survey as an opportunity to vent by writing in the margins or wherever space was available, complaining about lack of planning time, inability to collaborate with their colleagues due to scheduling issues, and dealing with paperwork. Some responses were darkly circled several times.

CHAPTER V

SUMMARY

The first portion of this research consisted of comparing the mathematics scores of eighth graders from 21 schools on the mathematics portion of the SAT 10. The pre-inception of AMSTI's eighth grade mathematics scores were compared with the post-inception of AMSTI's eighth grade mathematics scores. The results of the *t* test indicate the change was not statistically significant. If these statistics are to be accepted, one must accept that at this time with these schools, AMSTI has not been successful in improving mathematics scores on the SAT 10 for eighth graders within one year. Existing literature contradicts this result. Jean Piaget believed hands-on for mathematics would help children to learn; Vygotsky believed children learned better in groups interacting with their peers; John Dewey created his laboratory school to prove hands-on, real life experiences were the right path to understanding. John Gardner (1991) has said there are eight intelligences, ways in which children learn - techniques incorporated into AMSTI. While it is not necessary to incorporate all eight into a lesson, it is beneficial to the child to have opportunities in which to learn using different intelligences. *A Nation at Risk* told educators that eighth grade mathematics should teach for understanding so there would be a strong base of knowledge for high school, and that it should be interesting. Wiggins and McTighe (2001) state that it would be a good idea to let children uncover a lesson rather than have a teacher cover the lesson, meaning, allow the children to discover information and answers for themselves. The benefit of this approach according to Goldman and Hasselbring (1997) is that if a child understands the "how and why" of a subject, he or she is able to retrieve that information more readily. Were they all wrong?

Limitations

Several limitations were discovered. First, in order for a school to be chosen as part of this research, 80% of the schools' math and science teachers had to have attended at least one AMSTI Summer Institute. Having 80% of the teachers trained in AMSTI is what constitutes a true ASMTI school. However, that would not guarantee that teachers who have been trained in schools that did not meet the 80% criteria were not providing ideas to their peers and modeling AMSTI techniques. Also, these comparisons of SAT 10 mathematics scores were based on pre-inception of AMSTI and the first year post-inception of AMSTI. Since the SAT 10 assessment was taken by the students in the spring, there was not a lot of time for the teachers to teach utilizing AMSTI. Also, as with most new things, the more familiar a teacher is with a technique, greater is the likelihood he or she will become more effective with it. In addition, there is no guarantee that the teachers used AMSTI techniques – just that the teachers had been trained. The schools selected were from the mid-Alabama and southern Alabama areas of the state. However, the researcher believes had she collected data from the northern part of Alabama where AMSTI was first initiated, and collected data for a longer period of time, not just the first year post-inception of AMSTI, there would be a greater probability the mathematics scores for eighth graders on the SAT 10 would have reflected an increase.

Recommendations for Practice

It is important to remember, that while this is a research based on the eighth grade scores, these are not the same students each year who are assessed. Each year a new group of eighth graders is tested, and groups of students vary. While results did indicate no statistical significance, due to the fact that the majority of schools in this study were

relatively new to AMSTI, some caution should be in order regarding the result. Mathematics test scores from the SAT 10 on the same group of students as they progress through high school are in order. This would provide a clearer picture of the effectiveness of AMSTI.

Recommendations for Future Research

The researcher believes another study should be conducted among these same schools in two or three years to see if the SAT 10 mathematics scores have improved. It would also be interesting to complete a *t* test on a group of schools that have been participating in AMSTI since its inception, which would yield long range data.

Teachers' Perceptions Regarding AMSTI Survey

The second portion of the research consisted of a survey "Teachers Perceptions Regarding AMSTI Survey." It contained nine prompts for teachers to respond to on their perceptions regarding AMSTI.

The first query on the survey was "Local Pacing Guide requirements hinder my ability to plan and execute AMSTI lessons." The researcher was interested if the school systems were hindering the Alabama Mathematics, Science, and Technology Initiative by issuing a directive regarding when and what concepts should be taught to a degree the classroom teachers had a difficult time enacting AMSTI lessons. Over half of the Bibb County Public School teachers agreed. Other school systems that had a greater percentage agreeing to the statement were Mobile and Baldwin County Public School teachers. Perhaps these school systems should ensure that local pacing guides are aligned with the State Course of Study and SAT 10 assessments as is AMSTI. This would help to ensure that teachers would be better able to plan and enact AMSTI lessons.

The second query was "AMSTI lessons have increased my students' scores on the SAT." Almost half of the eighth grade teachers agreed or strongly agreed to the prompt and they had the highest percentage. The teachers of the seventh grade responded favorably with the lowest percentage followed by the fifth grade teachers.

The third query, "Generally I believe AMSTI has helped to increase test scores for my students," resulted in low percentages for the kindergarten and first grade teachers, and for the fifth and seventh grade teachers. The second and third query indicates the fifth grade teachers do not believe ASMTI has helped their test scores or their SAT 10 mathematics scores. The eighth grade teachers, based upon the second and third query believe AMSTI has helped to raise scores on both the SAT 10 and other math scores.

When based upon years of experience all groups report with more than half the responders that AMSTI has helped to make them a better mathematics teacher. Those with seven through nine years answered with the highest percentage. When the same queries' responses were collected by grade, all grades represented responded with more than half of the teachers answering favorably.

If the AMSTI program is to work, one could assume the more the AMSTI lessons are enacted the clearer picture one could achieve regarding its worth. The school systems enacting lessons the most often were Bibb, Talladega County, Shelby County, and Chilton County. Clarke County teachers stand out as the teachers who enact AMSTI lessons the least. By grade those students with the least access to AMSTI lessons are the seventh graders, high school, and eighth graders. Yet, eighth grade teachers reported that AMSTI training has helped to make them better math teachers and that their test scores are improving as well. The children who are the greatest recipients of AMSTI lessons are

the kindergarteners, and in descending order the second, first, and fourth graders. However, the kindergarten through second grade teachers report some of the lowest percentages regarding the query that AMSTI is helping to improve test scores. The discrepancies might be because of the nature of the assessments taken at those grade levels.

Non-instructional demands are affecting the enactment of AMSTI lessons to the greatest degree in descending order in the fifth grade, third grade, and kindergarten, and these grades all answered the query with more than half of the teachers agreeing to the query. When responding to the query by school system, these school systems' teachers believe the non-instructional demands inhibit their ability to enact AMSTI lessons: Homewood City school teachers, Talladega City school teachers, and Mobile County school teachers, with more than half of these teachers agreeing or strongly agreeing. The school systems doing the best job of unencumbering their teachers from non-instructional demands appears to be Shelby County, Bibb County, and Chilton County. It is interesting to note, none of those school systems had favorable responses from more than half their teachers. Clearly, school system administrators should explore ways to alleviate paperwork and other tasks that keep teachers from planning meaningful mathematics lessons.

The teachers of grades eight, high school, and second grade had the greatest percentage of teachers who attended three or more mathematics workshops the previous year. However, the greatest percentage of teachers who attended one or more was the fourth, second, first, and fifth grade teachers. When responses were collected by school system, all of the Bibb County teachers reported attending at least one mathematics

workshop this past school year, followed by the teachers in Baldwin County, Vestavia City, and Homewood City. In addition, the Bibb County teachers also had the highest percentage of those teachers who enact AMSTI lessons and whose teachers responded with one of the lowest percentages to non-instructional demands inhibiting them from enacting lessons. Whereas, Homewood City teachers are among the teachers with the highest percentage who attended at least one mathematics workshop; they also responded with a high percentage to non-instructional demands inhibiting their ability to enact AMSTI lessons. Homewood City teachers had one of the lowest percentages of the number of AMSTI lessons they enact.

Arranging a schedule so teachers can collaborate would seem like something that would be easy to do and could give teachers a chance to collaborate. This is accomplished with the most success for teachers of the following grades: second, third, eighth, fifth, and kindergarten. This is accomplished with the least success for the high school teachers by a margin of two-to-one when compared to the other grades. Other teachers of grades sixth, seventh, and fourth report having the ability to collaborate with the aid of scheduling.

The twenty-first century has greeted us with an infusion of technology. A nation of technology users is mandatory now, and AMSTI has incorporated technology into mathematics. Technology is supplied in the kits given to the teachers upon completion of their first Summer Institute. Are the teachers utilizing the technology? The teachers of the following grades responded favorably with the highest percentages in this order; eighth, seventh, high school, and sixth. The lowest percentage of favorable responses was from the fifth grade teachers.

Aligned Queries

Kindergarten teachers were among the smallest recipients of mathematics workshops, but among the highest in the belief that AMSTI is helping them to be better math teachers and have the highest percentage in believing AMSTI is helping to increase test scores. They also report using technology less than all but the fifth grade teachers. Attending mathematics workshops and believing that AMSTI is helping the teachers to become better mathematics teachers seems to complement each other for the first, second, and seventh grade teachers. One percentage that is especially interesting occurred with the seventh grade teachers who had an exact percentage match between the two queries. Fourth, fifth, and high school had among the highest percentages for attending workshops, but the highest discrepancy for believing that AMSTI is helping them to become better mathematics teachers.

If the purpose of attending mathematics workshops is to help increase test scores than the perception does not appear to transfer. The closest alignment is found in the first grade, but there are some large differences in percentage points found in especially the fifth and high school grades. Overall, the discrepancies are not closely aligned.

If non-instructional demands impact the teachers' ability to enact AMSTI lessons, it follows then that those teachers would report with the least conviction that their test scores have increased due to AMSTI. The fifth grade teachers had the highest percentage of non-instructional demands intruding, and the second lowest percentage of a belief that their test scores are improving because of AMSTI. The third grade teachers reported the second highest percentage of non-instructional demands intruding and fourth lowest percentage that AMSTI is helping their test scores. The eighth grade teachers reported the

second from the least percentage regarding non-instructional demands intruding but 45.5% of the teachers believe it is helping their test scores.

Bibb County and Talladega County had an identical match to AMSTI helping the teacher to become a better mathematics teacher and the local pacing guide inhibiting his or her ability to enact AMSTI lessons. However, the percentages for the two school systems were different. They were the counties with the highest percentages for the two queries. Otherwise, the remaining counties exhibit responses with higher percentages to the query "I believe AMSTI has made me a better mathematics teacher" and lower responses to the query "Local pacing guide requirements hinder my ability to plan and execute AMSTI lessons."

If a mathematics teacher enacts a higher percentage of AMSTI lessons, will that teacher believe the students' SAT 10 mathematics test scores are going to increase? The fourth grade teachers had the highest percentage regarding enacting AMSTI lessons, and the second highest percentage to the query that their students' SAT 10 test scores have increased. Oddly, the eighth grade teachers had the lowest percentage for enacting AMSTI lessons, but the highest percentage in the belief it is helping to increase SAT 10 test scores. Third grade teachers had the second highest percentage for enacting AMSTI lessons, and a significantly lower percentage in the belief AMSTI has helped to increase SAT 10 scores. The fifth grade teachers had the third highest percentage for enacting AMSTI lessons, but only 14.8% of the teachers believe AMSTI it is helping to increase SAT 10 mathematics scores. The more AMSTI lessons taught does not seem to imply with any great significance that the teachers believe it will improve the SAT 10 mathematics scores.

Do teachers who incorporate technology into mathematics lessons also believe that AMSTI has helped them to become better mathematics teachers? The teachers of the eighth grade reported the highest agreement to both "AMSTI training has allowed me to incorporate technology into my mathematics lessons," as well as the query "AMSTI has made me a better mathematics teacher." They were an exact match. Percentages that were in excess of 50% to both responses were the teachers of the sixth grade, seventh grade, eighth grade, and high school.

Limitations

The results of this survey reflect the views of teachers from two locations, the University of South Alabama site and the University of Montevallo site, in attendance for their second year of AMSTI Summer Institute. It should be noted that the responders to the survey were teachers who had only one year of AMSTI training completed. So basically these teachers were still somewhat new to AMSTI. It might be helpful to survey mathematics teachers who have been participating in AMSTI for a longer period of time.

Recommendations for Practice

AMSTI appears to have many positive aspects. The AMSTI program appears to be hampered primarily by local school board policies. Percentages in excess of 25% are too high for a query that asks if a local pacing guide inhibits a teacher from enacting ASMTI lessons. Why bother sending a teacher to workshops and the AMSTI Summer Institute, if when the teacher returns to the classroom, he or she does not have the freedom to plan and execute AMSTI lessons? This is what is happening across the state of Alabama. AMSTI has a projected budget of 35.8 million dollars for the 2008-2009 school year. Therefore, increased freedom for the teachers to plan and execute AMSTI lessons should

be considered. School board personnel should consider the possibility that AMSTI may have the answer, and align the local pacing guide to allow time for AMSTI lessons. Creators of local pacing guides should take care to align their pacing guides with not only the state course of study but the SAT 10 assessment as well.

Non-instructional demands are hampering too many teachers from enacting AMSTI lessons. Significantly more than a third of the teachers responded with agree or strongly agree to that prompt. This researcher deems that as unnecessary and an easy fix. For AMSTI to work, local school system administrators should consider what is truly necessary in the way of non-instructional demands.

The teachers believe that AMSTI is helping them to become better teachers of mathematics as exhibited in the query by years of experience that "I believe AMSTI has made me a better mathematics teacher." If it is true, one gets what one expects; the power of positive thinking could benefit Alabama students.

Since valuable ideas can be exchanged teacher-to-teacher, it seems logical to create schedules for teachers in which this can occur. Too many teachers are not given the opportunity according to the responses given by teachers. It is another simple fix.

It appears to the researcher that the fifth grade teachers are the least enthused about AMSTI. They have the one of the lowest percentages for the belief that AMSTI will help to improve their students SAT 10 scores, other student mathematics test scores, and they have the highest percentage of teachers who responded that non-instructional demands intrude upon their ability to enact ASMTI mathematics lessons.

Recommendations for Future Research

Another study to be completed comprised of more than just the first year post-inception of AMSTI is warranted. Since the SAT 10 scores fell after the first year of AMSTI, the researcher believes at least three years post-inception of AMSTI SAT 10 scores should be explored. Also, it would be beneficial to explore why the SAT 10 eighth grade math scores fell for many of the schools that were included. Is it possible teachers could use more intervention from AMSTI specialists, at least at the inception? This researcher thinks it is not fair to the AMSTI program to say it is not working based upon the *t* test that was conducted on 21 new AMSTI schools and included schools from only the mid-Alabama and southern Alabama regions. Also, the researcher believes it is necessary to attempt to follow a block of students and to assess if over time their SAT 10 scores in mathematics are higher than their peers who are not enrolled in AMSTI schools.

In some queries majorities of teachers complained about having non-instructional demands, and local pacing guides hampering their efforts to enact AMSTI mathematics lessons. Administration at the central office level might wish to revisit their local pacing guide if they have one to make certain it is aligned with not only the State Course of Study but the Sat 10 assessment as well. AMSTI is aligned with the State Course of Study and the SAT 10, so it would be much easier to enact AMSTI lessons and still be on track.

Fifth grade teachers answer prompts with percentages that made their grade stand out as an anomaly. The Alabama State Department of Education may wish to explore why the fifth grade teachers answered the queries as they did.

Final Summary

It is important to remember that it cannot be assumed that the teachers surveyed were representative of all Alabama school teachers. The teachers surveyed were teachers who had attended one AMSTI Summer Institute and were in attendance for their second AMSTI Summer Institute. Furthermore, the teachers were either from the southern portion of Alabama or the mid-portion of the state. The schools that were chosen for this research were from the same areas as well. Local pacing guides can be an asset to a school academic program, but care should be taken to align them with the Alabama State Course of Study and the SAT 10 assessment. While the researcher understands that some paperwork and other non-instructional demands upon the teacher are necessary for the safe and efficient operation of a school, additional care should be in order to ensure demands upon a teachers' time are truly necessary.

As previously stated, the researcher believes the same group of students should be tracked over years to ascertain what the long range effects of AMSTI are upon the students SAT 10 mathematics scores. Does AMSTI seem to have an effect on the reduction of high school drop outs? Furthermore, it might be interesting as well to track the same teachers who were surveyed and see if they feel that AMSTI has had a positive effect on the mathematics scores of their students as time progresses. Is it possible that with an AMSTI program in effect that there is greater teacher retention? There is much left to explore.

Finally, further independent assessments of AMSTI must continue to be conducted. With the budget AMSTI has been granted, it is only fair to the taxpayers of the state of Alabama that their tax dollars are being wisely and fruitfully spent.

APPENDIX A

TEACHERS' PERCEPTIONS REGARDING AMSTI SURVEY

What is the name of the school in which you teach? _____

In what county is it located? _____

How many years have you taught mathematics? Circle one.

1 – 3 4 – 6 7 – 9 10+ years

What grade do you primarily teach?

K 1 2 3 4 5 6 7 8 9 10 11 12

Local Pacing Guide requirements hinder my ability to plan and execute AMSTI lessons.

Strongly Disagree Strongly Agree

1 2 3 4 5

AMSTI lessons have increased my students' scores on the SAT.

Strongly Disagree Strongly Agree

1 2 3 4 5

not applicable to my grade

Generally I believe AMSTI has helped to increase test scores for my students.

Strongly Disagree Strongly Agree

1 2 3 4 5

I believe AMSTI has made me a better mathematics teacher.

Strongly Disagree Strongly Agree

1 2 3 4 5

I enact AMSTI lessons- (circle one)

daily two or more a week at least 2-4 a month

once a month 2-3 a quarter zero

Other demands (paper work, etc.) placed upon me by my school or central office administration has impacted my ability in a negative way to enact AMSTI lessons.

Strongly Disagree Strongly Agree

1 2 3 4 5

An objective of AMSTI is that teachers are allowed to attend content specific (mathematics) workshops. How many content specific workshops did you attend this past year? (circle one)

None 1-2 3 or more

I am allowed to collaborate with colleagues during planning periods.

Strongly Disagree Strongly Agree

1 2 3 4 5

AMSTI training has allowed me to incorporate technology into my mathematics lessons.

Strongly Disagree Strongly Agree

1 2 3 4 5

APPENDIX B

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **28052204**
PROJECT TITLE: **Teachers' Perceptions Regarding AMSTI Survey**
PROPOSED PROJECT DATES: **06/02/08 to 06/28/08**
PROJECT TYPE: **Dissertation or Thesis**
PRINCIPAL INVESTIGATORS: **Brenda Jolly**
COLLEGE/DIVISION: **College of Education & Psychology**
DEPARTMENT: **Educational Leadership & Research**
FUNDING AGENCY: **N/A**
HSPRC COMMITTEE ACTION: **Expedited Review Approval**
PERIOD OF APPROVAL: **05/23/08 to 05/22/09**

Lawrence A. Hosman
Lawrence A. Hosman, Ph.D.
HSPRC Chair

6-03-08
Date

HUMAN SUBJECTS REVIEW FORM
UNIVERSITY OF SOUTHERN MISSISSIPPI
(SUBMIT THIS FORM IN DUPLICATE)

Protocol # 28052204
(office use only)

Name Brenda Jolly Phone 251-639-9957

E-Mail Address olemissalm@hotmail.com

Mailing Address 10621 Hunters Ridge Drive Mobile, Alabama 36695
(address to receive information regarding this application)

College/Division Educational Leadership & Research Dept Ed. Administration Supervision

Department Box # _____ Phone _____

Proposed Project Dates: From June 2, 2008 To June 28, 2008
(specific month, day and year of the beginning and ending dates of full project, not just data collection)

Title Teachers Perceptions Regarding AMSTI Survey

Funding Agencies or Research Sponsors none

Grant Number (when applicable) none

_____ New Project

x Dissertation or Thesis

_____ Renewal or Continuation: Protocol # _____

_____ Change in Previously Approved Project: Protocol # _____

Brenda Jolly 4/29/08
Principal Investigator Date

Gaylynn Parker 4/29/08
Advisor Date

Gaylynn Parker 4/29/08
Department Chair Date

RECOMMENDATION OF HSPRC MEMBER

_____ Category I, Exempt under Subpart A, Section 46.101 ( ) ( ), 45CFR46.

✓ Category II, Expedited Review, Subpart A, Section 46.110 and Subparagraph (7).

_____ Category III, Full Committee Review.

5/22/08
HSPRC College/Division Member DATE

Lawrence A. Hosman 6-02-08
HSPRC Chair DATE

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